

# **Agilent**

## **2-Port and 4-Port**

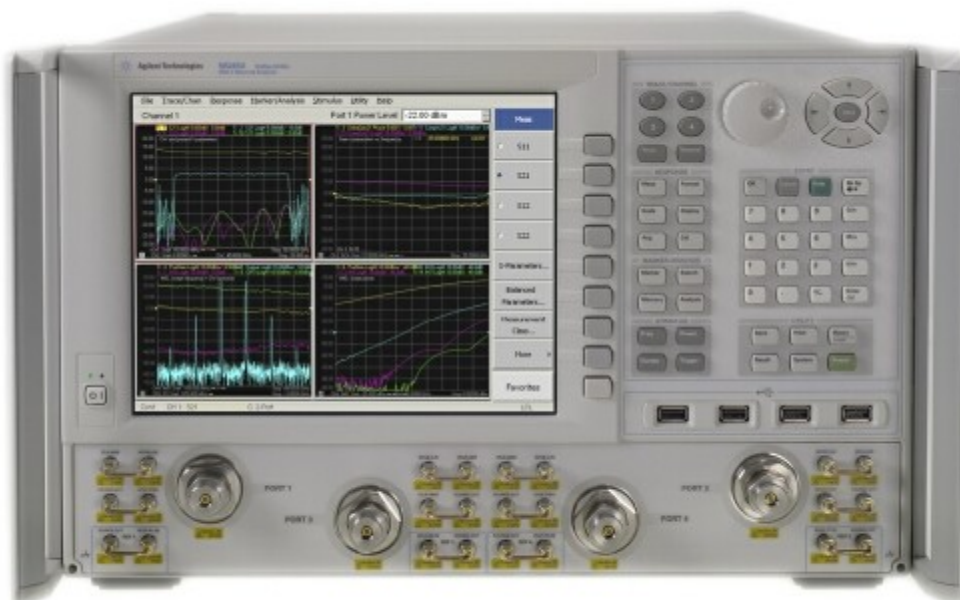
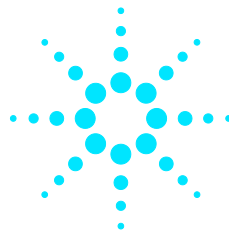
### **PNA-X Network Analyzer**

**N5244A - 10 MHz to 43.5 GHz**

**N5245A - 10 MHz to 50.0 GHz**

Data Sheet and

Technical Specifications



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This is a complete list of the technical specifications for the N5244A and N5245A PNA-X network analyzer with the following options:

**Option 200**, 2-port standard test set (includes six front-panel access loops) and power range. [See the block diagram.](#)

**Option 219**, adds 2-port extended power range, source and receiver attenuators, and bias-tees (requires Option 200). [See the block diagram.](#)

**Option 224**, adds an internal second source, a combiner, and mechanical switches to the 2-port analyzer (requires Option 200, 219, and 080). [See the block diagram.](#)

**Option 400**, 4-port standard test set (includes twelve front-panel access loops), power range, and an internal second source (Option 080 recommended). [See the block diagram.](#)

**Option 419**, adds 4-port extended power range, source and receiver attenuators, and bias-tees (requires Option 400). [See the block diagram.](#)

**Option 423**, adds an internal combiner, and mechanical switches to the 4-port analyzer (requires Option 400, 419, and 080). [See the block diagram.](#)

#### Note

This document provides technical specifications for the 85056A calibration kit, the N4693A 4-Port ECal module, and the N4691B 2-Port ECal module. Please download our free Uncertainty Calculator from [http://www.agilent.com/find/na\\_calculator](http://www.agilent.com/find/na_calculator) to generate the curves for your calibration kit and PNA setup.

## Definitions

All specifications and characteristics apply over a 25 °C  $\pm$ 5 °C range (unless otherwise stated) and 90 minutes after the instrument has been turned on.

**Specification (spec.):** Warranted performance. Specifications include guardbands to account for the expected statistical performance distribution, measurement uncertainties, and changes in performance due to environmental conditions.

**Characteristic (char.):** A performance parameter that the product is expected to meet before it leaves the factory, but that is not verified in the field and is not covered by the product warranty. A characteristic includes the same guardbands as a specification.

**Typical (typ.):** Expected performance of an average unit which does not include guardbands. It is not covered by the product warranty.

**Nominal (nom.):** A general, descriptive term that does not imply a level of performance. It is not covered by the product warranty.

**Calibration:** The process of measuring known standards to characterize a network analyzer's systematic (repeatable) errors.

**Corrected (residual):** Indicates performance after error correction (calibration). It is determined by the quality of calibration standards and how well "known" they are, plus system repeatability, stability, and noise.

**Uncorrected (raw):** Indicates instrument performance without error correction. The uncorrected performance affects the stability of a calibration.

**Standard:** When referring to the analyzer, this includes no options unless noted otherwise.

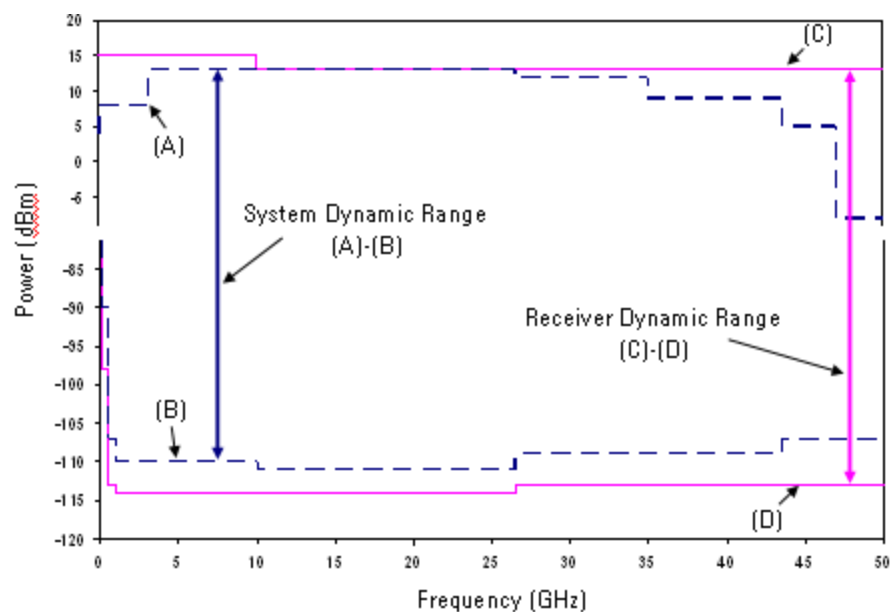
## Corrected System Performance

The specifications in this section apply for measurements made with the N5244A and N5245A analyzer with the following conditions:

- 10 Hz IF bandwidth
- No averaging applied to data
- Isolation calibration with an averaging factor of 8

## System Dynamic Range and Receiver Dynamic Range

- **System Dynamic Range** is defined as the max leveled output power (spec) minus the noise floor (spec).
- **Receiver Dynamic Range** is defined as the test port compression at 0.1 dB (typical) minus the noise floor (typical).



**Table 1. System Dynamic Range Option 200 or 400, and Receiver Dynamic Range – All Options**

| Description                    | Specification             |                                |                             | Typical                     |                                       |                             |
|--------------------------------|---------------------------|--------------------------------|-----------------------------|-----------------------------|---------------------------------------|-----------------------------|
|                                | System Dynamic Range (dB) | Max Leveled Output Power (dBm) | Test Port Noise Floor (dBm) | Receiver Dynamic Range (dB) | Test Port Compression at 0.1 dB (dBm) | Test Port Noise Floor (dBm) |
|                                | (A)-(B)                   | (A)                            | (B)                         | (C)-(D)                     | (C)                                   | (D)                         |
| <b>Ports</b>                   | <b>1,3</b>                | <b>1,3</b>                     | <b>All</b>                  | <b>All</b>                  | <b>All</b>                            | <b>All</b>                  |
| 10 MHz to 50 MHz <sup>3</sup>  | 74                        | 4                              | -70                         | 91                          | 15                                    | -76                         |
| 50 MHz to 100 MHz <sup>3</sup> | 93                        | 8                              | -85                         | 106                         | 15                                    | -91                         |

|                                 |     |    |      |     |    |      |
|---------------------------------|-----|----|------|-----|----|------|
| 100 MHz to 500 MHz <sup>3</sup> | 98  | 8  | -90  | 113 | 15 | -98  |
| 500 MHz to 1 GHz                | 114 | 8  | -106 | 127 | 15 | -112 |
| 1 GHz to 2 GHz                  | 118 | 8  | -110 | 129 | 15 | -114 |
| 2 GHz to 3.2 GHz                | 118 | 8  | -110 | 129 | 15 | -114 |
| 3.2 GHz to 10 GHz               | 123 | 13 | -110 | 129 | 15 | -114 |
| 10 GHz to 16 GHz                | 124 | 13 | -111 | 127 | 13 | -114 |
| 16 GHz to 20 GHz                | 124 | 13 | -111 | 127 | 13 | -114 |
| 20 GHz to 26.5 GHz              | 124 | 13 | -111 | 127 | 13 | -114 |
| 26.5 GHz to 30 GHz              | 120 | 12 | -108 | 126 | 13 | -113 |
| 30 GHz to 32 GHz                | 119 | 11 | -108 | 126 | 13 | -113 |
| 32 GHz to 35 GHz                | 120 | 12 | -108 | 126 | 13 | -113 |
| 35 GHz to 40 GHz                | 117 | 9  | -108 | 126 | 13 | -113 |
| 40 GHz to 43.5 GHz              | 118 | 9  | -109 | 126 | 13 | -113 |
| 43.5 GHz to 47 GHz              | 112 | 5  | -107 | 126 | 13 | -113 |
| <i>47 GHz to 50 GHz</i>         | 99  | -8 | -107 | 126 | 13 | -113 |

**Table 2a. System Dynamic Range at Test Port <sup>1</sup> - Option 200 or 400**

| Description                     | Specification (dB) at Test Port |                          | Typical (dB) at Test Port |                          |
|---------------------------------|---------------------------------|--------------------------|---------------------------|--------------------------|
|                                 | Port 1 or 3 <sup>2</sup>        | Port 2 or 4 <sup>2</sup> | Port 1 or 3 <sup>2</sup>  | Port 2 or 4 <sup>2</sup> |
| 10 MHz to 50 MHz <sup>3</sup>   | 74                              | 82                       | 85                        | 93                       |
| 50 MHz to 100 MHz <sup>3</sup>  | 93                              | 98                       | 102                       | 110                      |
| 100 MHz to 500 MHz <sup>3</sup> | 98                              | 103                      | 109                       | 117                      |
| 500 MHz to 1 GHz                | 114                             | 119                      | 123                       | 128                      |
| 1 GHz to 2 GHz                  | 118                             | 123                      | 125                       | 130                      |
| 2 GHz to 3.2 GHz                | 118                             | 123                      | 125                       | 130                      |
| 3.2 GHz to 10 GHz               | 123                             | 123                      | 131                       | 131                      |
| 10 GHz to 16 GHz                | 124                             | 124                      | 130                       | 129                      |
| 16 GHz to 20 GHz                | 124                             | 124                      | 129                       | 130                      |
| 20 GHz to 26.5 GHz              | 124                             | 124                      | 129                       | 130                      |
| 26.5 GHz to 30 GHz              | 120                             | 120                      | 129                       | 129                      |
| 30 GHz to 32 GHz                | 119                             | 119                      | 128                       | 128                      |
| 32 GHz to 35 GHz                | 120                             | 120                      | 129                       | 129                      |
| 35 GHz to 40 GHz                | 117                             | 117                      | 126                       | 126                      |
| 40 GHz to 43.5 GHz              | 118                             | 118                      | 126                       | 126                      |
| 43.5 GHz to 47 GHz              | 112                             | 112                      | 123                       | 123                      |
| <i>47 GHz to 50 GHz</i>         | 99                              | 99                       | 112                       | 112                      |

<sup>1</sup> The system dynamic range is calculated as the difference between the noise floor and the specified source maximum output power. The effective dynamic range must take measurement uncertainties and interfering signals into account.

<sup>2</sup> Either port can be used as the source port. Any other port can be used as the receiver port.

<sup>3</sup> May typically be degraded at particular frequencies below 500 MHz due to spurious receiver residuals.



**Table 2b. System Dynamic Range at Test Port <sup>1</sup> - Option 219 or 419**

| Description                     | Specification (dB) at Test Port |                          | Typical (dB) at Test Port |                          |
|---------------------------------|---------------------------------|--------------------------|---------------------------|--------------------------|
|                                 | Port 1 or 3 <sup>2</sup>        | Port 2 or 4 <sup>2</sup> | Port 1 or 3 <sup>2</sup>  | Port 2 or 4 <sup>2</sup> |
| 10 MHz to 50 MHz <sup>3</sup>   | 74                              | 82                       | 87                        | 93                       |
| 50 MHz to 100 MHz <sup>3</sup>  | 93                              | 98                       | 102                       | 111                      |
| 100 MHz to 500 MHz <sup>3</sup> | 98                              | 103                      | 109                       | 118                      |
| 500 MHz to 1 GHz                | 114                             | 119                      | 125                       | 130                      |
| 1 GHz to 2 GHz                  | 118                             | 123                      | 125                       | 133                      |
| 2 GHz to 3.2 GHz                | 118                             | 123                      | 128                       | 132                      |
| 3.2 GHz to 10 GHz               | 123                             | 123                      | 130                       | 130                      |
| 10 GHz to 16 GHz                | 122                             | 122                      | 127                       | 127                      |
| 16 GHz to 20 GHz                | 121                             | 121                      | 127                       | 127                      |
| 20 GHz to 26.5 GHz              | 121                             | 121                      | 127                       | 127                      |
| 26.5 GHz to 30 GHz              | 117                             | 117                      | 126                       | 126                      |
| 30 GHz to 32 GHz                | 115                             | 115                      | 124                       | 124                      |
| 32 GHz to 35 GHz                | 117                             | 117                      | 126                       | 126                      |
| 35 GHz to 40 GHz                | 112                             | 112                      | 121                       | 121                      |
| 40 GHz to 43.5 GHz              | 113                             | 113                      | 121                       | 121                      |
| 43.5 GHz to 47 GHz              | 106                             | 106                      | 118                       | 118                      |
| 47 GHz to 50 GHz                | 93                              | 93                       | 105                       | 105                      |

<sup>1</sup> The system dynamic range is calculated as the difference between the noise floor and the specified source maximum output power. The effective dynamic range must take measurement uncertainties and interfering signals into account.

<sup>2</sup> Either port can be used as the source port. Any other port can be used as the receiver port.

<sup>3</sup> May typically be degraded at particular frequencies below 500 MHz due to spurious receiver residuals.

**Table 2c. System Dynamic Range at Test Port <sup>1</sup> - Option 224**

| Description                     | Specification (dB) at Test Port |                   | Typical (dB) at Test Port |                   |
|---------------------------------|---------------------------------|-------------------|---------------------------|-------------------|
|                                 | Source 2<br>Out 1               | Source 2<br>Out 2 | Source 2<br>Out 1         | Source 2<br>Out 2 |
| 10 MHz to 50 MHz <sup>2</sup>   | 74                              | 83                | 86                        | 93                |
| 50 MHz to 100 MHz <sup>2</sup>  | 93                              | 100               | 102                       | 110               |
| 100 MHz to 500 MHz <sup>2</sup> | 98                              | 105               | 109                       | 117               |
| 500 MHz to 1 GHz                | 114                             | 119               | 123                       | 129               |
| 1 GHz to 2 GHz                  | 118                             | 123               | 125                       | 131               |
| 2 GHz to 3.2 GHz                | 118                             | 123               | 125                       | 131               |
| 3.2 GHz to 10 GHz               | 124                             | 126               | 132                       | 133               |
| 10 GHz to 16 GHz                | 123                             | 124               | 130                       | 130               |
| 16 GHz to 20 GHz                | 125                             | 125               | 132                       | 132               |
| 20 GHz to 26.5 GHz              | 125                             | 125               | 132                       | 132               |
| 26.5 GHz to 30 GHz              | 122                             | 122               | 131                       | 132               |
| 30 GHz to 32 GHz                | 121                             | 122               | 130                       | 132               |
| 32 GHz to 35 GHz                | 122                             | 122               | 131                       | 132               |
| 35 GHz to 40 GHz                | 119                             | 120               | 128                       | 128               |
| 40 GHz to 43.5 GHz              | 120                             | 121               | 128                       | 128               |
| 43.5 GHz to 47 GHz              | 114                             | 115               | 126                       | 126               |
| 47 GHz to 50 GHz                | 102                             | 102               | 115                       | 118               |

<sup>1</sup> The system dynamic range is calculated as the difference between the noise floor and the specified source maximum output power. The effective dynamic range must take measurement uncertainties and interfering signals into account.

<sup>2</sup> May typically be degraded at particular frequencies below 500 MHz due to spurious receiver residuals.

**Table 2d. System Dynamic Range at Test Port <sup>1</sup> - Option 224 or 423**

| Description                     | Specification (dB)<br>at Test Port |                             | Typical (dB) at Test Port   |                             |                               |                                |
|---------------------------------|------------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------------------------|--------------------------------|
|                                 | Port 1<br>or 3 <sup>2</sup>        | Port 2<br>or 4 <sup>2</sup> | Port 1<br>or 3 <sup>2</sup> | Port 2<br>or 4 <sup>2</sup> | Source1-Port1<br>Combine Mode | Source 2-Port1<br>Combine Mode |
| 10 MHz to 50 MHz <sup>3</sup>   | 74                                 | 80                          | 87                          | 95                          | 80                            | 81                             |
| 50 MHz to 100 MHz <sup>3</sup>  | 93                                 | 98                          | 102                         | 110                         | 95                            | 95                             |
| 100 MHz to 500 MHz <sup>3</sup> | 98                                 | 103                         | 109                         | 117                         | 102                           | 102                            |
| 500 MHz to 1 GHz                | 114                                | 119                         | 122                         | 128                         | 116                           | 116                            |
| 1 GHz to 2 GHz                  | 118                                | 123                         | 124                         | 130                         | 118                           | 118                            |
| 2 GHz to 3.2 GHz                | 118                                | 123                         | 124                         | 130                         | 118                           | 118                            |
| 3.2 GHz to 10 GHz               | 123                                | 123                         | 130                         | 130                         | 122                           | 121                            |
| 10 GHz to 16 GHz                | 122                                | 122                         | 127                         | 127                         | 118                           | 118                            |
| 16 GHz to 20 GHz                | 121                                | 121                         | 127                         | 127                         | 116                           | 116                            |
| 20 GHz to 26.5 GHz              | 121                                | 121                         | 127                         | 127                         | 116                           | 116                            |
| 26.5 GHz to 30 GHz              | 117                                | 117                         | 126                         | 126                         | 114                           | 113                            |
| 30 GHz to 32 GHz                | 115                                | 115                         | 124                         | 124                         | 114                           | 113                            |
| 32 GHz to 35 GHz                | 117                                | 117                         | 126                         | 126                         | 114                           | 113                            |
| 35 GHz to 40 GHz                | 112                                | 112                         | 121                         | 121                         | 109                           | 108                            |
| 40 GHz to 43.5 GHz              | 113                                | 113                         | 121                         | 121                         | 109                           | 108                            |
| 43.5 GHz to 47 GHz              | 105                                | 105                         | 117                         | 118                         | 105                           | 103                            |
| <i>47 GHz to 50 GHz</i>         | 92                                 | 92                          | 106                         | 107                         | 93                            | 89                             |

<sup>1</sup> The system dynamic range is calculated as the difference between the noise floor and the specified source maximum output power. The effective dynamic range must take measurement uncertainties and interfering signals into account.

<sup>2</sup> Either port can be used as the source port. Any other port can be used as the receiver port.

<sup>3</sup> May typically be degraded at particular frequencies below 500 MHz due to spurious receiver residuals.

**Table 3a. Extended Dynamic Range at Direct Receiver Access Input<sup>1</sup> - Option 200 or 400**

| Description                     | Specification (dB) at Direct Receiver Access Input |                          |
|---------------------------------|--|--------------------------|
|                                 | Port 1 or 3 <sup>2</sup>                           | Port 2 or 4 <sup>2</sup> |
| 10 MHz to 50 MHz <sup>3</sup>   | 109  | 117                      |
| 50 MHz to 100 MHz <sup>3</sup>  | 113  | 118                      |
| 100 MHz to 500 MHz <sup>3</sup> | 118  | 123                      |
| 500 MHz to 1 GHz                | 135  | 140                      |
| 1 GHz to 2 GHz                  | 138  | 143                      |
| 2 GHz to 3.2 GHz                | 130  | 135                      |
| 3.2 GHz to 10 GHz               | 135  | 135                      |
| 10 GHz to 16 GHz                | 136  | 136                      |
| 16 GHz to 20 GHz                | 136  | 136                      |
| 20 GHz to 26.5 GHz              | 134  | 134                      |
| 26.5 GHz to 30 GHz              | 130  | 130                      |
| 30 GHz to 32 GHz                | 129  | 129                      |
| 32 GHz to 35 GHz                | 130  | 130                      |
| 35 GHz to 40 GHz                | 127  | 127                      |
| 40 GHz to 43.5 GHz              | 126  | 126                      |
| 43.5 GHz to 47 GHz              | 120  | 120                      |
| 47 GHz to 50 GHz                | 107  | 107                      |

<sup>1</sup> The direct receiver access input extended dynamic range is calculated as the difference between the direct receiver access input noise floor and the source maximum output power. The effective dynamic range must take measurement uncertainties and interfering signals into account. This set-up should only be used when the receiver input will never exceed its maximum receiver input. When the analyzer is in segment sweep mode, it can have predefined frequency segments which will output a higher power level when the extended dynamic range is required (i.e. devices with high insertion loss), and reduced power when the maximum receiver input level will occur (i.e. devices with low insertion loss). The extended range is only available in one-path transmission measurements.

<sup>2</sup> Either port can be used as the source port. Any other port can be used as the receiver port.

<sup>3</sup> May typically be degraded at particular frequencies below 500 MHz due to spurious receiver residuals.

**Table 3b. Extended Dynamic Range at Direct Receiver Access Input<sup>1</sup> - Option 219 or 419**

| Description                     | Specification (dB) at Direct Receiver Access Input |                          |
|---------------------------------|--|--------------------------|
|                                 | Port 1 or 3 <sup>2</sup>                           | Port 2 or 4 <sup>2</sup> |
| 10 MHz to 50 MHz <sup>3</sup>   | 109  | 117                      |
| 50 MHz to 100 MHz <sup>3</sup>  | 113  | 118                      |
| 100 MHz to 500 MHz <sup>3</sup> | 118  | 123                      |
| 500 MHz to 1 GHz                | 135  | 140                      |
| 1 GHz to 2 GHz                  | 138  | 143                      |
| 2 GHz to 3.2 GHz                | 130  | 135                      |
| 3.2 GHz to 10 GHz               | 135  | 135                      |
| 10 GHz to 16 GHz                | 134  | 134                      |
| 16 GHz to 20 GHz                | 133  | 133                      |
| 20 GHz to 26.5 GHz              | 131  | 131                      |
| 26.5 GHz to 30 GHz              | 127  | 127                      |
| 30 GHz to 32 GHz                | 125  | 125                      |
| 32 GHz to 35 GHz                | 127  | 127                      |
| 35 GHz to 40 GHz                | 122  | 122                      |
| 40 GHz to 43.5 GHz              | 121  | 121                      |
| 43.5 GHz to 47 GHz              | 114  | 114                      |
| 47 GHz to 50 GHz                | 101  | 101                      |

<sup>1</sup> The direct receiver access input extended dynamic range is calculated as the difference between the direct receiver access input noise floor and the source maximum output power. The effective dynamic range must take measurement uncertainties and interfering signals into account. This set-up should only be used when the receiver input will never exceed its maximum receiver input. When the analyzer is in segment sweep mode, it can have predefined frequency segments which will output a higher power level when the extended dynamic range is required (i.e. devices with high insertion loss), and reduced power when the maximum receiver input level will occur (i.e. devices with low insertion loss). The extended range is only available in one-path transmission measurements.

<sup>2</sup> Either port can be used as the source port. Any other port can be used as the receiver port.

<sup>3</sup> May typically be degraded at particular frequencies below 500 MHz due to spurious receiver residuals.

**Table 3c. Extended Dynamic Range at Direct Receiver Access Input<sup>1</sup> - Option 224**

| Description                     | Specification (dB) at Direct Receiver Access Input |                   |
|---------------------------------|--|-------------------|
|                                 | Source 2<br>Out 1                                  | Source 2<br>Out 2 |
| 10 MHz to 50 MHz <sup>2</sup>   | 109  | 118               |
| 50 MHz to 100 MHz <sup>2</sup>  | 113  | 120               |
| 100 MHz to 500 MHz <sup>2</sup> | 118  | 125               |
| 500 MHz to 1 GHz                | 135  | 140               |
| 1 GHz to 2 GHz                  | 138  | 143               |
| 2 GHz to 3.2 GHz                | 130  | 135               |
| 3.2 GHz to 10 GHz               | 136  | 138               |
| 10 GHz to 16 GHz                | 135  | 136               |
| 16 GHz to 20 GHz                | 137  | 137               |
| 20 GHz to 26.5 GHz              | 135  | 135               |
| 26.5 GHz to 30 GHz              | 132  | 132               |
| 30 GHz to 32 GHz                | 131  | 132               |
| 32 GHz to 35 GHz                | 132  | 132               |
| 35 GHz to 40 GHz                | 129  | 130               |
| 40 GHz to 43.5 GHz              | 128  | 129               |
| 43.5 GHz to 47 GHz              | 122  | 123               |
| 47 GHz to 50 GHz                | 110  | 110               |

<sup>1</sup> The direct receiver access input extended dynamic range is calculated as the difference between the direct receiver access input noise floor and the source maximum output power. The effective dynamic range must take measurement uncertainties and interfering signals into account. This set-up should only be used when the receiver input will never exceed its compression or damage level. When the analyzer is in segment sweep mode, it can have predefined frequency segments which will output a higher power level when the extended dynamic range is required (i.e. devices with high insertion loss), and reduced power when receiver compression or damage may occur (i.e. devices with low insertion loss). The extended range is only available in one-path transmission measurements.

<sup>2</sup> May typically be degraded at particular frequencies below 500 MHz due to spurious receiver residuals.

**Table 3d. Extended Dynamic Range at Direct Receiver Access Input<sup>1</sup> - Option 224 or 423**

| Description                     | Specification (dB) at Direct Receiver Access Input |                          |                                  |                                  |
|---------------------------------|--|--------------------------|----------------------------------|----------------------------------|
|                                 | Port 1 or 3 <sup>2</sup>                           | Port 2 or 4 <sup>2</sup> | Source 1, Port 1<br>Combine Mode | Source 2, Port 1<br>Combine Mode |
| 10 MHz to 50 MHz <sup>3</sup>   | 109  | 115                      | 115                              | 116                              |
| 50 MHz to 100 MHz <sup>3</sup>  | 113  | 118                      | 115                              | 115                              |
| 100 MHz to 500 MHz <sup>3</sup> | 118  | 123                      | 122                              | 122                              |
| 500 MHz to 1 GHz                | 135  | 140                      | 137                              | 137                              |
| 1 GHz to 2 GHz                  | 138  | 143                      | 138                              | 138                              |
| 2 GHz to 3.2 GHz                | 130  | 135                      | 130                              | 130                              |
| 3.2 GHz to 10 GHz               | 135  | 135                      | 134                              | 133                              |
| 10 GHz to 16 GHz                | 134  | 134                      | 130                              | 130                              |
| 16 GHz to 20 GHz                | 133  | 133                      | 128                              | 128                              |
| 20 GHz to 26.5 GHz              | 131  | 131                      | 126                              | 126                              |
| 26.5 GHz to 30 GHz              | 127  | 127                      | 124                              | 123                              |
| 30 GHz to 32 GHz                | 125  | 125                      | 124                              | 123                              |
| 32 GHz to 35 GHz                | 127  | 127                      | 124                              | 123                              |
| 35 GHz to 40 GHz                | 122  | 122                      | 119                              | 118                              |
| 40 GHz to 43.5 GHz              | 121  | 121                      | 117                              | 116                              |
| 43.5 GHz to 47 GHz              | 113  | 113                      | 113                              | 111                              |
| 47 GHz to 50 GHz                | 100  | 100                      | 101                              | 97                               |

<sup>1</sup> The direct receiver access input extended dynamic range is calculated as the difference between the direct receiver access input noise floor and the source maximum output power. The effective dynamic range must take measurement uncertainties and interfering signals into account. This set-up should only be used when the receiver input will never exceed its compression or damage level. When the analyzer is in segment sweep mode, it can have predefined frequency segments which will output a higher power level when the extended dynamic range is required (i.e. devices with high insertion loss), and reduced power when receiver compression or damage may occur (i.e. devices with low insertion loss). The extended range is only available in one-path transmission measurements.

<sup>2</sup> Either port can be used as the source port. Any other port can be used as the receiver port.

<sup>3</sup> May typically be degraded at particular frequencies below 500 MHz due to spurious receiver residuals.





## N5244A and N5245A Corrected System Performance - All Options

Note: For any  $S_{ii}$  reflection measurement:

- $S_{jj} = 0$ .

For any  $S_{ij}$  transmission measurement:

- $S_{ji} = S_{ij}$  when  $S_{ij} \leq 1$
- $S_{ji} = 1/S_{ij}$  when  $S_{ij} > 1$
- $S_{kk} = 0$  for all  $k$

### Table 4. 85056A Calibration Kit

#### N5244A and N5245A All Options

Applies to the N5244A and N5245A Option 200 or 219 or 224 or 400 or 419 or 423 analyzers, 85056A (2.4 mm) calibration kit, 85133F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Environmental temperature  $23^\circ \pm 3^\circ \text{C}$ , with  $< 1^\circ \text{C}$  deviation from calibration temperature

| Description                        | Specification (dB)      |                         |                         |                         |                        |
|------------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|------------------------|
|                                    | 50 MHz to<br>500 MHz    | 500 MHz to<br>2 GHz     | 2 GHz to<br>26.5 GHz    | 26.5 GHz to<br>43.5 GHz | 43.5 GHz to<br>50 GHz  |
| Directivity                        | 42                      | 42                      | 38                      | 36                      | 36                     |
| Source Match                       | 41                      | 41                      | 33                      | 31                      | 31                     |
| Load Match                         | 42                      | 42                      | 37                      | 35                      | 35                     |
| Reflection Tracking <sup>1</sup>   |                         |                         |                         |                         |                        |
| Mag                                | $\pm 0.001$             | $\pm 0.001$             | $\pm 0.020$             | $\pm 0.027$             | $\pm 0.027$            |
| Phase                              | $+0.009/^\circ\text{C}$ | $0.009/^\circ\text{C}$  | $0.133/^\circ\text{C}$  | $0.180/^\circ\text{C}$  | $0.180/^\circ\text{C}$ |
| Transmission Tracking <sup>1</sup> |                         |                         |                         |                         |                        |
| Mag                                | $\pm 0.020$             | $\pm 0.024$             | $\pm 0.093$             | $\pm 0.174$             | $\pm 0.182$            |
| Phase                              | $+0.135/^\circ\text{C}$ | $+0.155/^\circ\text{C}$ | $+0.615/^\circ\text{C}$ | $+1.148/^\circ\text{C}$ | $1.202/^\circ\text{C}$ |

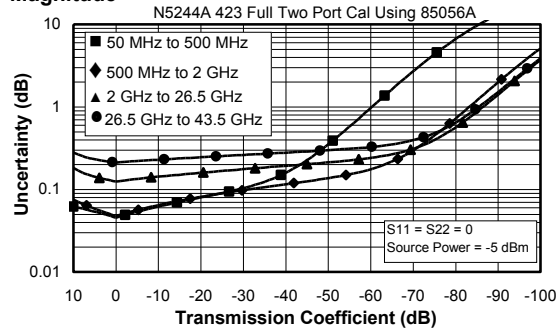
<sup>1</sup>Temperature deviation is a characteristic value.

## Transmission Uncertainty

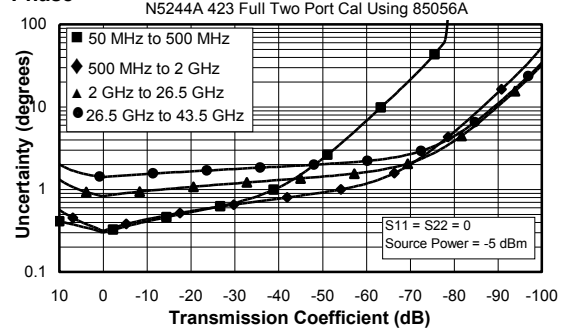
The following charts were generated for Option 423, although they are applicable for any option.

### N5244A Opt 423 with 85056A

**Magnitude**

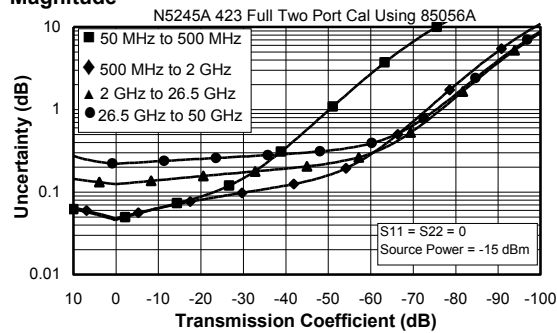


**Phase**

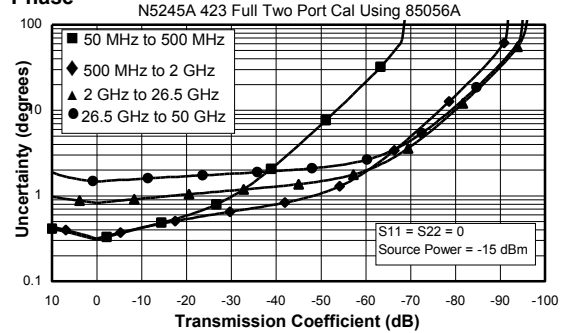


### N5245A Opt 423 with 85056A

**Magnitude**



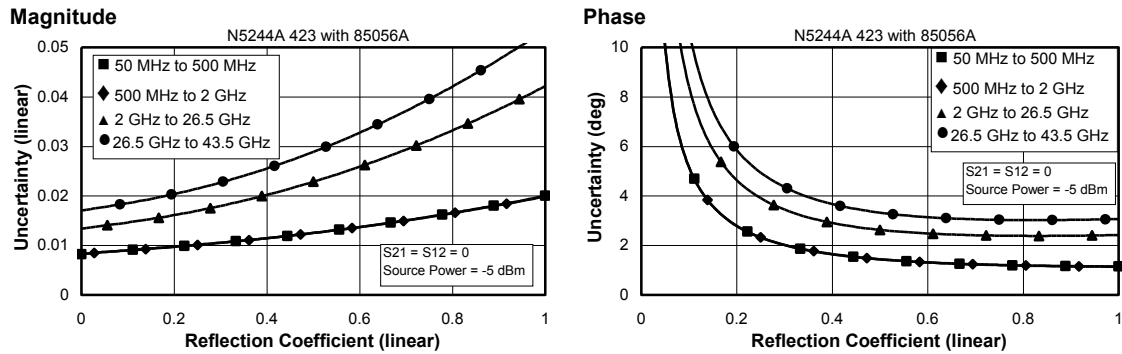
**Phase**



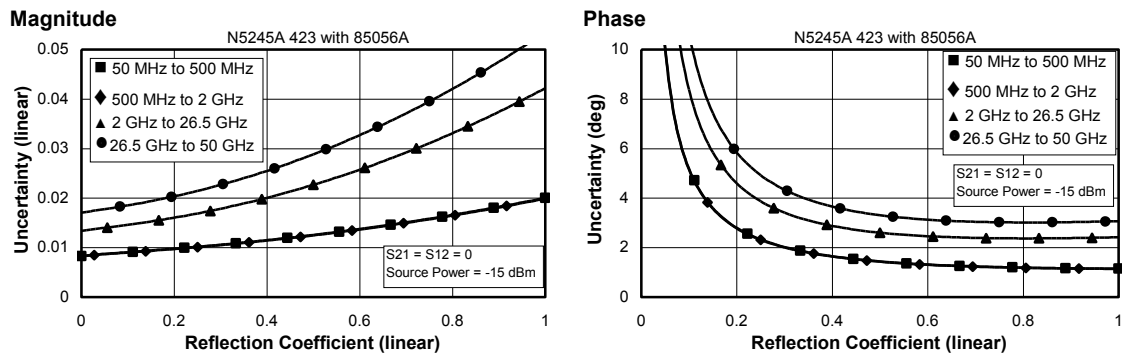
## Reflection Uncertainty

The following charts were generated for Option 423, although they are applicable for any option.

### N5244A Opt 423 with 85056A



### N5245A Opt 423 with 85056A



**Table 5. N4693A 2-Port Electronic Calibration Module****N5244A and N5245A All Options**

Note: Uncertainty curves for the N4693A are created using a 2-port calibration.

Applies to the N5244A and N5245A Option 200 or 219 or 224 or 400 or 419 or 423 analyzers, N4693A (2.4 mm) electronic calibration module, 85133F flexible test port cable set, and a full 2-port calibration. Also applies to the following condition:

Environmental temperature  $23^{\circ} \pm 3^{\circ} \text{C}$ , with  $< 1^{\circ} \text{C}$  deviation from calibration temperature

| Description                        | Specification (dB)       |                          |                          |                          |                          |
|------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|                                    | 50 MHz to<br>500 MHz     | 500 MHz to<br>2 GHz      | 2 GHz to<br>26.5 GHz     | 26.5 GHz to<br>43.5 GHz  | 43.5 GHz to<br>50 GHz    |
| Directivity                        | 32                       | 55                       | 45                       | 41                       | 41                       |
| Source Match                       | 25                       | 46                       | 37                       | 30                       | 30                       |
| Load Match                         | 25                       | 45                       | 36                       | 29                       | 29                       |
| Reflection Tracking <sup>1</sup>   |                          |                          |                          |                          |                          |
| Mag                                | $\pm 0.050$              | $\pm 0.030$              | $\pm 0.050$              | $\pm 0.080$              | $\pm 0.080$              |
| Phase                              | $0.330/^{\circ}\text{C}$ | $0.198/^{\circ}\text{C}$ | $0.330/^{\circ}\text{C}$ | $0.528/^{\circ}\text{C}$ | $0.528/^{\circ}\text{C}$ |
| Transmission Tracking <sup>1</sup> |                          |                          |                          |                          |                          |
| Mag                                | $\pm 0.084$              | $\pm 0.033$              | $\pm 0.065$              | $\pm 0.114$              | $\pm 0.114$              |
| Phase                              | $0.556/^{\circ}\text{C}$ | $0.218/^{\circ}\text{C}$ | $0.431/^{\circ}\text{C}$ | $0.754/^{\circ}\text{C}$ | $0.754/^{\circ}\text{C}$ |

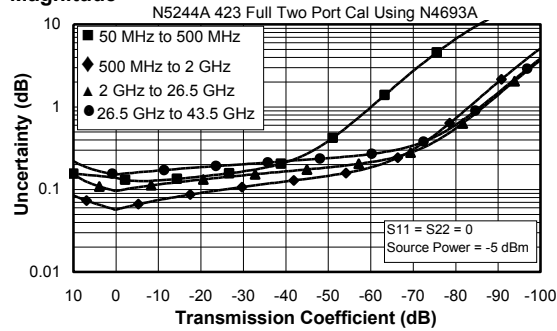
<sup>1</sup> Temperature deviation is a characteristic value.

## Transmission Uncertainty

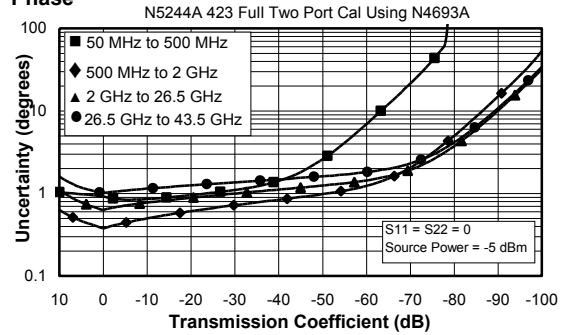
The following charts were generated for Option 423, although they are applicable for any option.

### N5244A Opt 423 with N4693A

**Magnitude**

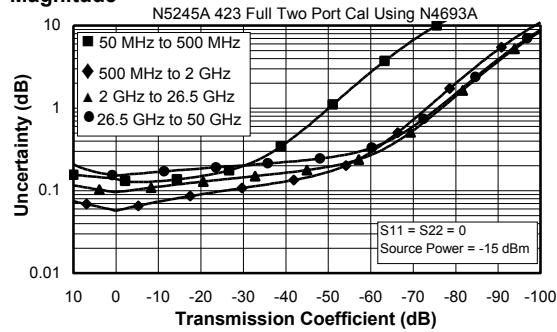


**Phase**

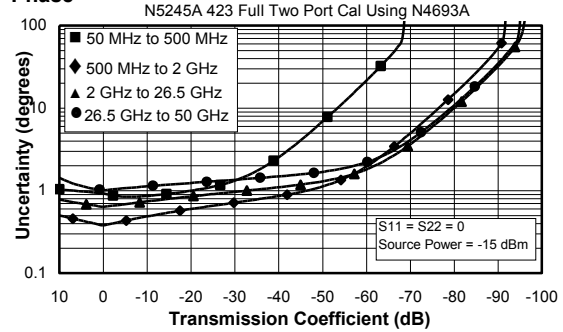


### N5245A Opt 423 with N4693A

**Magnitude**



**Phase**

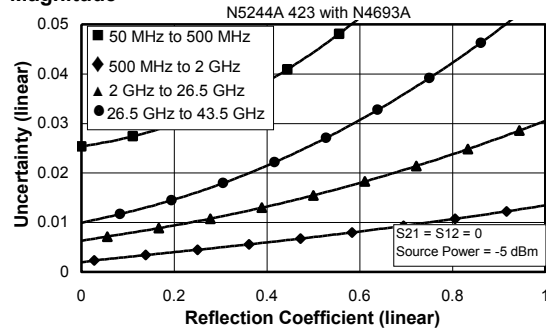


## Reflection Uncertainty

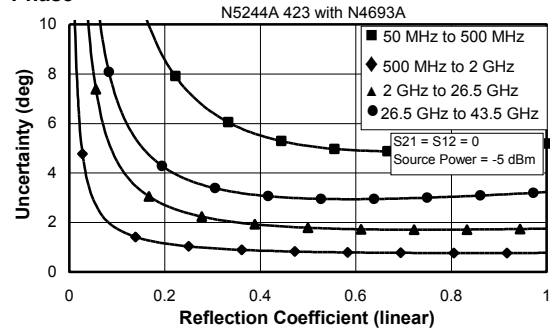
The following charts were generated for Option 423, although they are applicable for any option.

### N5244A Opt 423 with N4693A

Magnitude

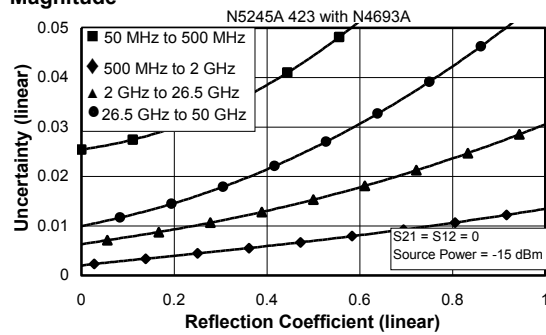


Phase

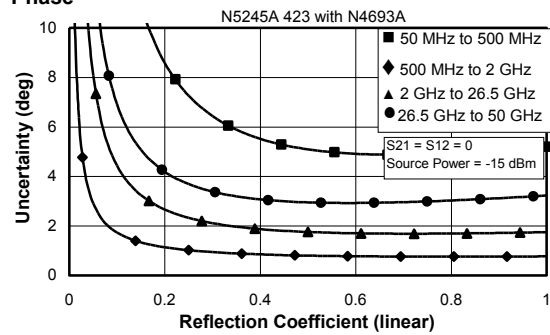


### N5245A Opt 423 with N4693A

Magnitude



Phase



## Uncorrected System Performance

**Table 6. Error Terms<sup>1</sup>**

**Ports 1, 2, 3, 4 - All Options**

| Directivity (dB)     | Specification | Typical |
|----------------------|---------------|---------|
| 10 MHz to 50 MHz     | 18            | 21      |
| 50 MHz to 200 MHz    | 22            | 27      |
| 200 MHz to 500 MHz   | 23            | 27      |
| 500 MHz to 3.2 GHz   | 23            | 30      |
| 3.2 GHz to 10 GHz    | 22            | 25      |
| 10 GHz to 13.5 GHz   | 18            | 23      |
| 13.5 GHz to 16 GHz   | 18            | 21      |
| 16 GHz to 20 GHz     | 18            | 20      |
| 20 GHz to 24 GHz     | 16            | 20      |
| 24 GHz to 26.5 GHz   | 16            | 22      |
| 26.5 GHz to 43.5 GHz | 16            | 21      |
| 43.5 GHz to 46 GHz   | 15            | 21      |
| 46 GHz to 50 GHz     | 15            | 19      |

**Table 6. (Continued) Error Terms<sup>1</sup>**

| <b>Source Match (dB)</b> | <b>Specification</b> | <b>Typical</b> |
|--------------------------|----------------------|----------------|
| 10 MHz to 50 MHz         | 10                   | 13             |
| 50 MHz to 500 MHz        | 18                   | 27             |
| 500 MHz to 3.2 GHz       | 16                   | 21             |
| 3.2 GHz to 10 GHz        | 14                   | 20             |
| 10 GHz to 13.5 GHz       | 12                   | 17             |
| 13.5 GHz to 16 GHz       | 12                   | 17             |
| 16 GHz to 20 GHz         | 12                   | 18             |
| 20 GHz to 24 GHz         | 11                   | 16             |
| 24 GHz to 26.5 GHz       | 11                   | 17             |
| 26.5 GHz to 43.5 GHz     | 7                    | 12             |
| 43.5 GHz to 46 GHz       | 7                    | 13             |
| 46 GHz to 50 GHz         | 6                    | 11             |
| <b>Load Match (dB)</b>   | <b>Specification</b> | <b>Typical</b> |
| 10 MHz to 50 MHz         | 10                   | 15             |
| 50 MHz to 500 MHz        | 16                   | 22             |
| 500 MHz to 3.2 GHz       | 14                   | 18             |
| 3.2 GHz to 10 GHz        | 13                   | 17             |
| 10 GHz to 13.5 GHz       | 11                   | 16             |
| 13.5 GHz to 16 GHz       | 11                   | 15             |
| 16 GHz to 20 GHz         | 11                   | 16             |
| 20 GHz to 24 GHz         | 10                   | 16             |
| 24 GHz to 26.5 GHz       | 10                   | 16             |
| 26.5 GHz to 43.5 GHz     | 7                    | 12             |
| 43.5 GHz to 46 GHz       | 7                    | 12             |
| 46 GHz to 50 GHz         | 7                    | 11             |



**Table 6. (Continued) Error Terms<sup>1</sup>**

| <b>Transmission Tracking<sup>3</sup> (dB)</b> | <b>Specification</b> | <b>Typical</b> |
|---|----------------------|----------------|
| 10 MHz to 43.5 GHz                            | --                   | +/-1.5         |
| 43.5 GHz to 50 GHz                            | --                   | +/-1.5         |

| <b>Reflection Tracking<sup>2</sup> (dB)</b> | <b>Specification</b> | <b>Typical</b> |
|---|----------------------|----------------|
| 10 MHz to 43.5 GHz                          | --                   | +/-1.5         |
| 43.5 GHz to 50 GHz                          | --                   | +/-1.5         |

| <b>Crosstalk<sup>3</sup>(dB)</b> | <b>Specification</b> | <b>Typical</b> |
|----------------------------------|----------------------|----------------|
| 10 MHz to 50 MHz                 | --                   | -82            |
| 50 MHz to 100 MHz                | --                   | -85            |
| 100 MHz to 500 MHz               | --                   | -110           |
| 500 MHz to 35 GHz                | --                   | -120           |
| 35 GHz to 43.5 GHz               | --                   | -115           |
| 43.5 GHz to 47 GHz               | --                   | -105           |
| 47 GHz to 50 GHz                 | --                   | -100           |

<sup>1</sup> Specifications apply over environmental temperature of 25 °C ±5 °C, with less than 1°C variation from the calibration temperature.

<sup>2</sup> Cable loss not included.

<sup>3</sup> Measurement conditions: normalized to a thru, measured with shorts on all ports, 10 Hz IF bandwidth, averaging factor of 8, alternate mode, source power set to the lesser of the maximum power-out or the maximum receiver power.

## Test Port Output

**Table 7. Frequency Information - All Options**

| Description            | Specification (dB) | Typical (dB)  |
|------------------------|--------------------|---|
| N5244A Frequency Range | 10 MHz to 43.5 GHz | --  |
| N5245A Frequency Range | 10 MHz to 50.0 GHz | --  |
| Frequency Resolution   | 1 Hz               | --  |
| Frequency Accuracy     | +/- 1 ppm          | --  |
| Frequency Stability    | --                 | +/-0.05 ppm, -10° to 70° C <sup>1</sup><br>+/-0.1 ppm/yr maximum <sup>2</sup> |

<sup>1</sup> Assumes no variation in time.

<sup>2</sup> Assumes no variation in temperature.

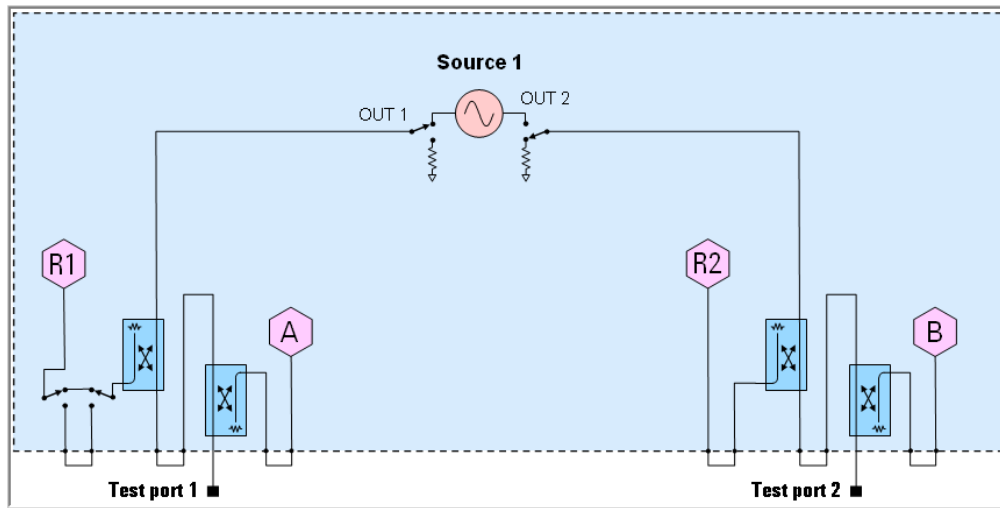
**Table 8a. Maximum Levelled Power - Option 200 or 400**

| Description        | Specification (dBm)  |  |                          | Typical (dBm)  |  |                          |
|--------------------|--|--|--------------------------|--|--|--------------------------|
|                    | Port 1 or 3 <sup>1</sup><br>Filtered<br>Mode <sup>2</sup><br>Figure 2 or<br>Figure 5 | Port 1 or 3 <sup>1</sup><br>Hi Pwr<br>Mode <sup>2</sup><br>Figure 3 or<br>Figure 6 | Port 2 or 4 <sup>1</sup> | Port 1 or 3 <sup>1</sup><br>Filtered<br>Mode <sup>2</sup><br>Figure 2 or<br>Figure 5 | Port 1 or 3 <sup>1</sup><br>Hi Pwr<br>Mode <sup>2</sup><br>Figure 3 or<br>Figure 6 | Port 2 or 4 <sup>1</sup> |
| 10 MHz to 50 MHz   | 4  | 12   | 12                       | 9  | 17   | 17                       |
| 50 MHz to 500 MHz  | 8  | 13   | 13                       | 11   | 18   | 19                       |
| 500 MHz to 1 GHz   | 8  | 13   | 13                       | 11   | 18   | 16                       |
| 1 GHz to 2 GHz     | 8  | 13   | 13                       | 11   | 16   | 16                       |
| 2 GHz to 3.2 GHz   | 8  | 10   | 13                       | 11   | 14   | 16                       |
| 3.2 GHz to 10 GHz  | 13   | 13   | 13                       | 17   | 17   | 17                       |
| 10 GHz to 16 GHz   | 13   | 13   | 13                       | 16   | 16   | 15                       |
| 16 GHz to 26.5 GHz | 13   | 13   | 13                       | 15   | 15   | 16                       |
| 26.5 GHz to 30 GHz | 12   | 12   | 12                       | 16   | 16   | 16                       |
| 30 GHz to 32 GHz   | 11   | 11   | 11                       | 15   | 15   | 15                       |
| 32 GHz to 35 GHz   | 12   | 12   | 12                       | 16   | 16   | 16                       |
| 35 GHz to 43.5 GHz | 9  | 9  | 9                        | 13   | 13   | 13                       |
| 43.5 GHz to 47 GHz | 5  | 5  | 5                        | 10   | 10   | 10                       |
| 47 GHz to 50 GHz   | -8   | -8   | -8                       | -1   | -1   | -1                       |

<sup>1</sup> Either port can be used as the source port.

<sup>2</sup> In Filtered Mode, the signal path goes through filters to minimize harmonics below 3.2 GHz. In Hi Pwr Mode, the signal bypasses the filters to maximize output power.

**Figure 1. Block Diagram, N5244A and N5245A Option 200**



**Figure 2. Path Configuration Diagram, N5244A and N5245A Option 200, Port 1 Filtered Mode**

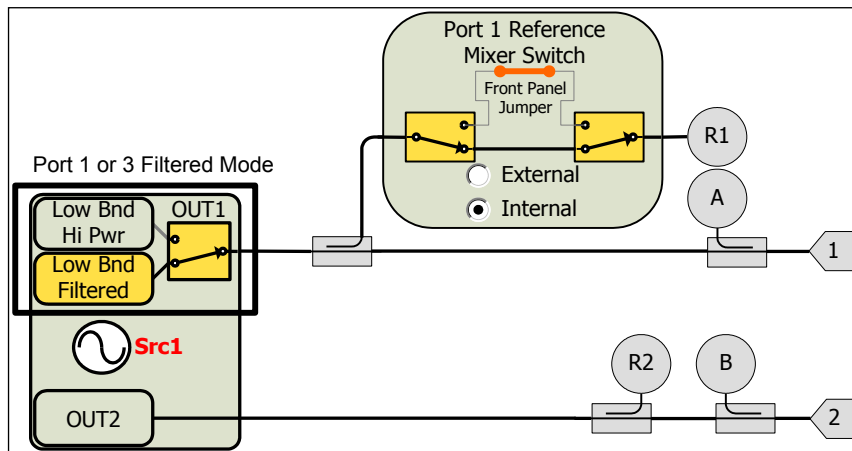


Figure 3. Path Configuration Diagram, N5244A and N5245A Option 200, Port 1 Hi Pwr Mode

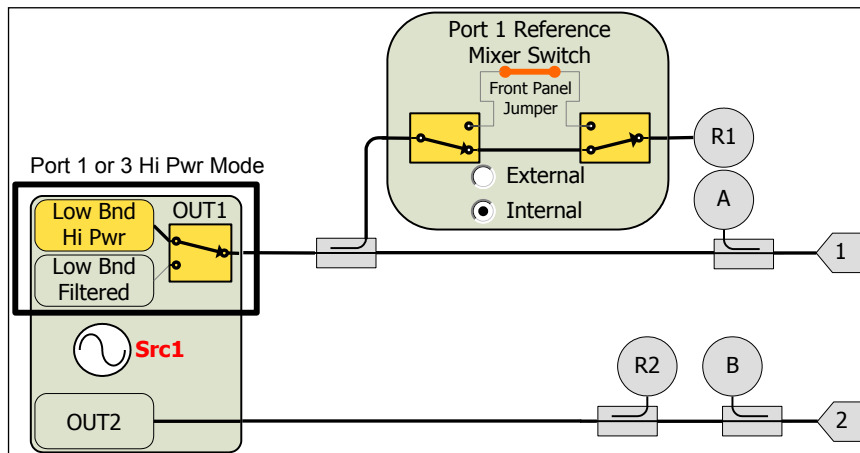


Figure 4. Block Diagram, N5244A and N5245A Option 400

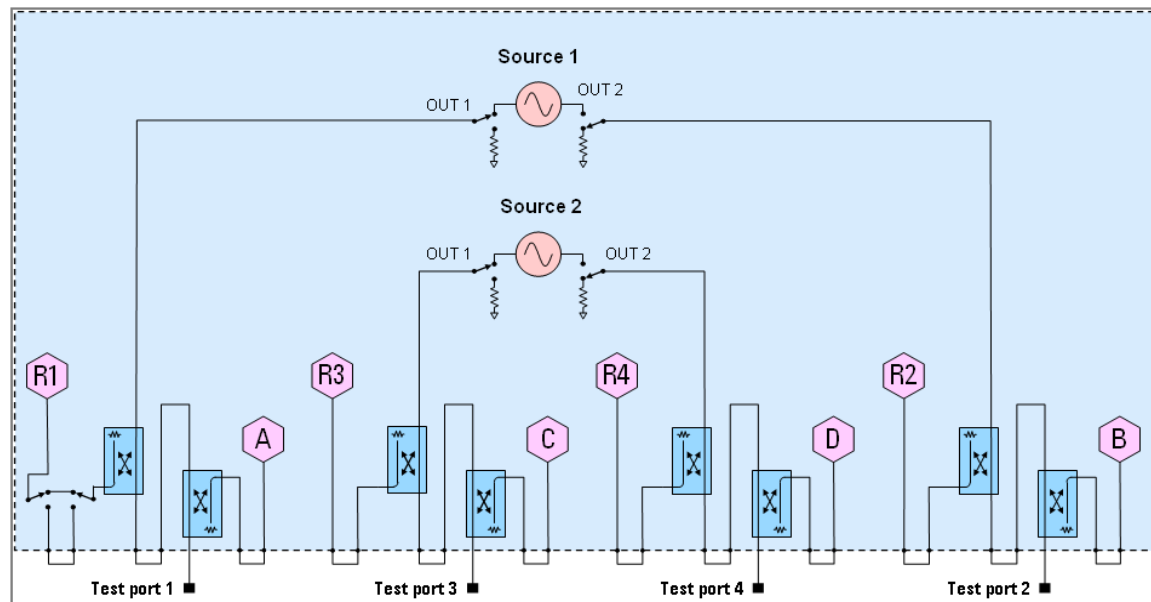


Figure 5. Path Configuration Diagram, N5244A and N5245A Option 400, Port 1 or 3 Filtered Mode

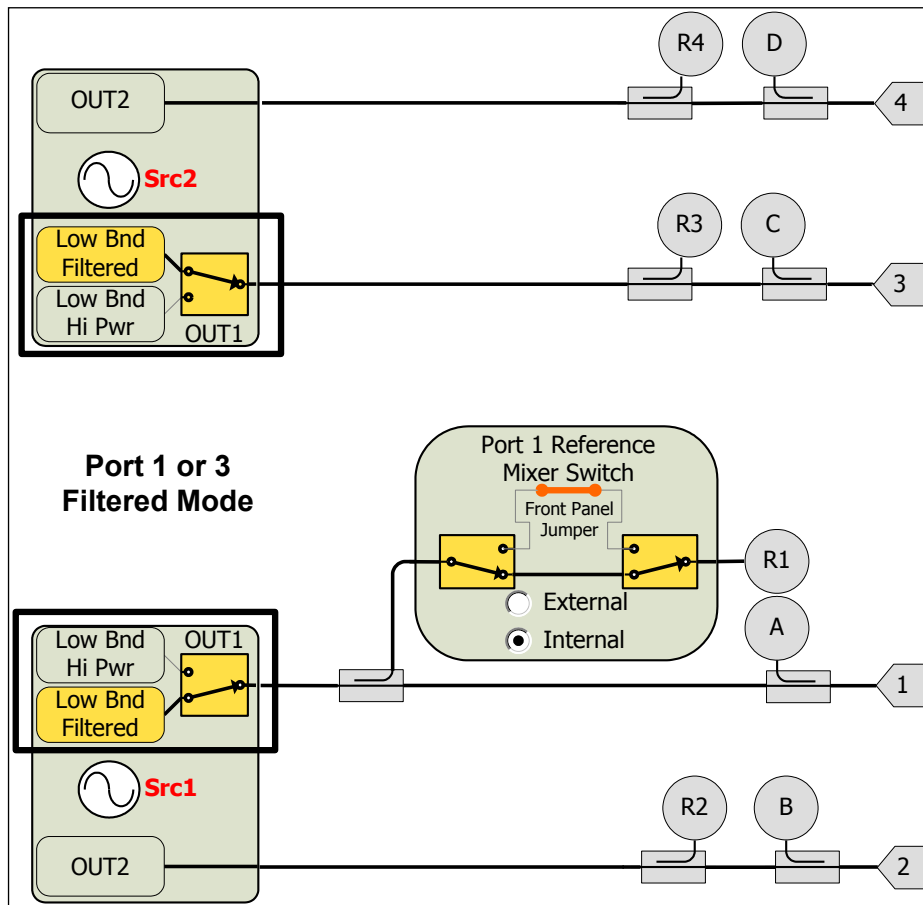
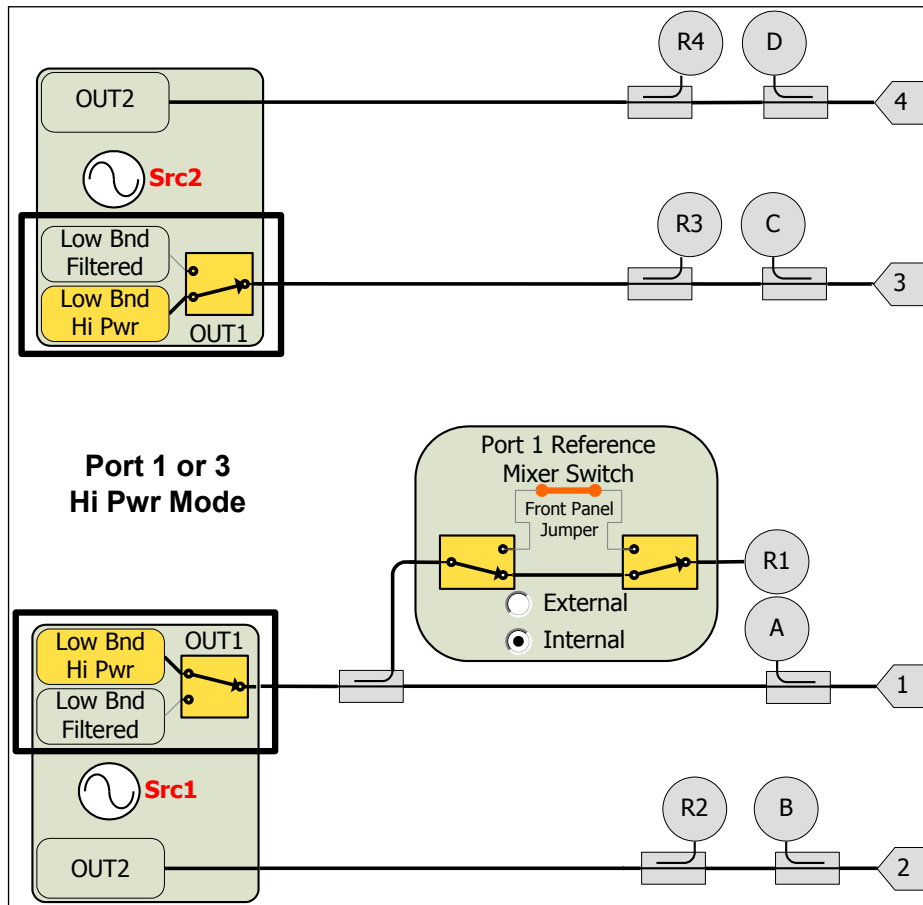


Figure 6. Path Configuration Diagram, N5244A and N5245A Option 400, Port 1 or 3 Hi Pwr Mode



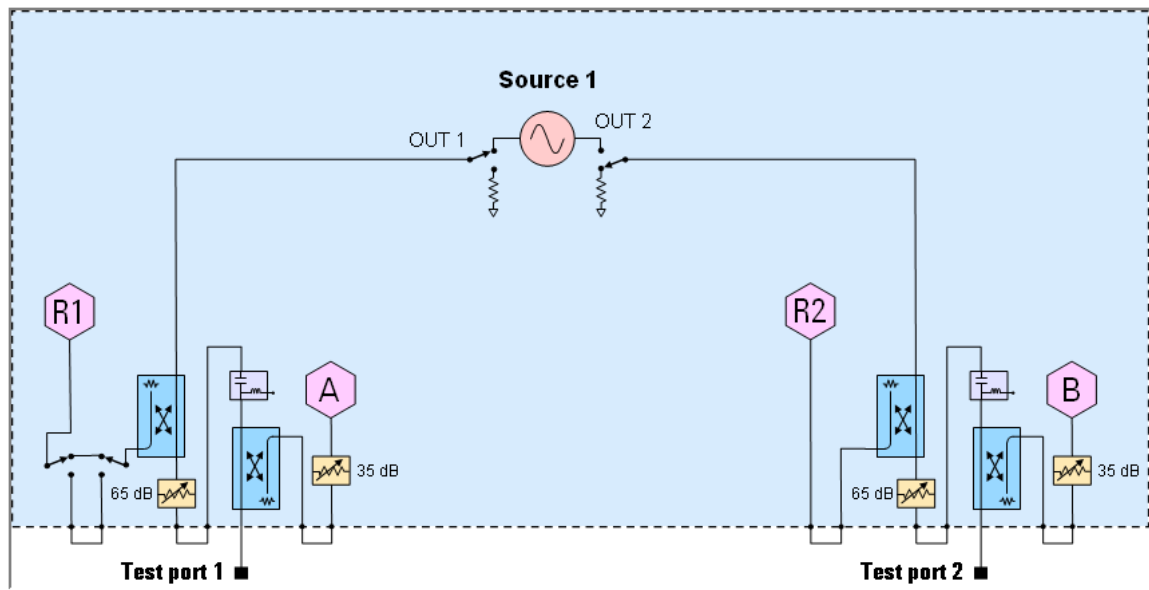
**Table 8b. Maximum Levelled Power - Option 219 or 419**

| Description        | Specification (dBm)                                       |   |                          | Typical (dBm)   |   |                          |
|--------------------|---|---|--------------------------|---|---|--------------------------|
|                    | Port 1 or 3 <sup>1</sup><br>Filtered<br>Mode <sup>2</sup> | Port 1 or 3 <sup>1</sup><br>Hi Pwr<br>Mode <sup>2</sup> | Port 2 or 4 <sup>1</sup> | Port 1 or 3 <sup>1</sup><br>Filtered<br>Mode <sup>2</sup> | Port 1 or 3 <sup>1</sup><br>Hi Pwr<br>Mode <sup>2</sup> | Port 2 or 4 <sup>1</sup> |
| 10 MHz to 50 MHz   | 4   | 9   | 12                       | 11  | 19  | 17                       |
| 50 MHz to 500 MHz  | 8   | 13  | 13                       | 11  | 20  | 20                       |
| 500 MHz to 1 GHz   | 8   | 13  | 13                       | 13  | 18  | 18                       |
| 1 GHz to 2 GHz     | 8   | 12  | 13                       | 11  | 17  | 19                       |
| 2 GHz to 3.2 GHz   | 8   | 10  | 13                       | 14  | 15  | 18                       |
| 3.2 GHz to 10 GHz  | 13  | 13  | 13                       | 16  | 16  | 16                       |
| 10 GHz to 16 GHz   | 11  | 11  | 11                       | 13  | 13  | 13                       |
| 16 GHz to 26.5 GHz | 10  | 10  | 10                       | 13  | 13  | 13                       |
| 26.5 GHz to 30 GHz | 9   | 9   | 9                        | 13  | 13  | 13                       |
| 30 GHz to 32 GHz   | 7   | 7   | 7                        | 11  | 11  | 11                       |
| 32 GHz to 35 GHz   | 9   | 9   | 9                        | 13  | 13  | 13                       |
| 35 GHz to 43.5 GHz | 4   | 4   | 4                        | 8   | 8   | 8                        |
| 43.5 GHz to 47 GHz | -1  | -1  | -1                       | 5   | 5   | 5                        |
| 47 GHz to 50 GHz   | -14   | -14   | -14                      | -8  | -8  | -8                       |

<sup>1</sup> Either port can be used as the source port.

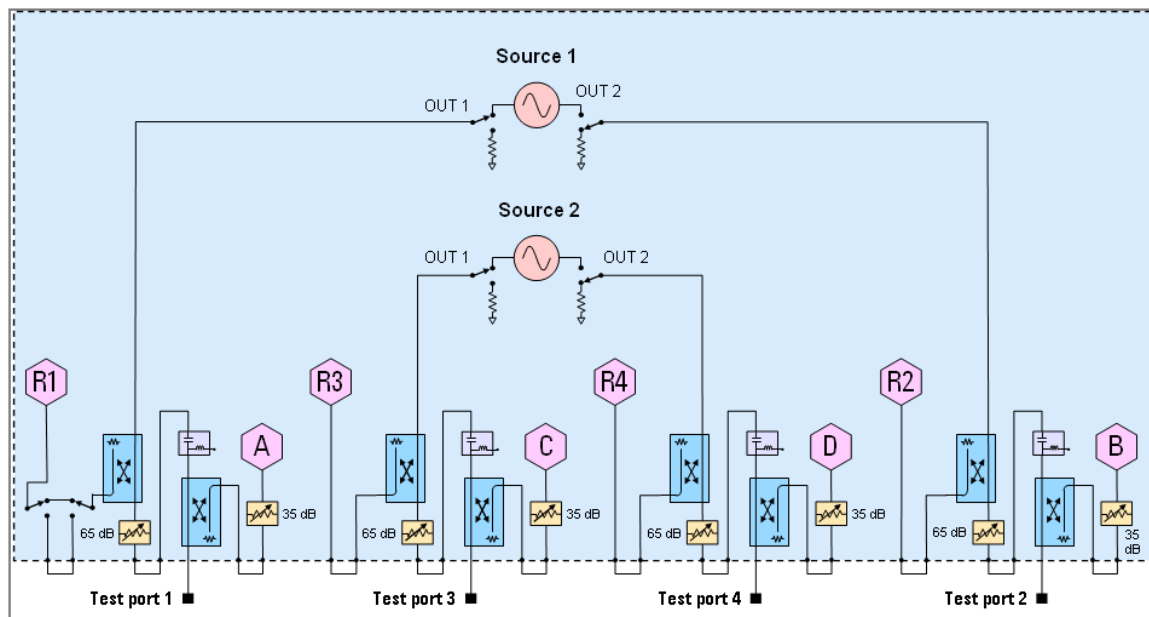
<sup>2</sup> In Filtered Mode, the signal path goes through filters to minimize harmonics below 3.2 GHz. In Hi Pwr Mode, the signal bypasses the filters to maximize output power.

Figure 7. Block Diagram, N5244A and N5245A Option 219



**Note:** The path configuration drawing for Option 219 is identical to the path configuration drawings for Option 200, which are shown in Figure 2 and Figure 3.

Figure 8. Block Diagram, N5244A and N5245A Option 419



**Note:** The path configuration drawing for Option 419 is identical to the path configuration drawings for Option 400, which are shown in Figure 5 and Figure 6.



**Table 8c. Maximum Leveled Power - Option 224 - Source 1**

| Description        | Specification (dBm)                     |                                       |        | Typical (dBm)                           |                                       |        |
|--------------------|---|---------------------------------------|--------|---|---------------------------------------|--------|
|                    | Port 1<br>Filtered<br>Mode <sup>1</sup> | Port 1<br>Hi Pwr<br>Mode <sup>1</sup> | Port 2 | Port 1<br>Filtered<br>Mode <sup>1</sup> | Port 1<br>Hi Pwr<br>Mode <sup>1</sup> | Port 2 |
| 10 MHz to 50 MHz   | 4                                       | 11                                    | 10     | 11                                      | 18                                    | 19     |
| 50 MHz to 500 MHz  | 8                                       | 13                                    | 13     | 11                                      | 18                                    | 19     |
| 500 MHz to 1 GHz   | 8                                       | 13                                    | 13     | 10                                      | 18                                    | 16     |
| 1 GHz to 2 GHz     | 8                                       | 13                                    | 13     | 10                                      | 16                                    | 16     |
| 2 GHz to 3.2 GHz   | 8                                       | 10                                    | 13     | 10                                      | 13                                    | 16     |
| 3.2 GHz to 10 GHz  | 13                                      | 13                                    | 13     | 16                                      | 16                                    | 16     |
| 10 GHz to 16 GHz   | 11                                      | 11                                    | 11     | 13                                      | 13                                    | 13     |
| 16 GHz to 26.5 GHz | 10                                      | 10                                    | 10     | 13                                      | 13                                    | 13     |
| 26.5 GHz to 30 GHz | 9                                       | 9                                     | 9      | 13                                      | 13                                    | 13     |
| 30 GHz to 32 GHz   | 7                                       | 7                                     | 7      | 11                                      | 11                                    | 11     |
| 32 GHz to 35 GHz   | 9                                       | 9                                     | 9      | 13                                      | 13                                    | 13     |
| 35 GHz to 43.5 GHz | 4                                       | 4                                     | 4      | 8                                       | 8                                     | 8      |
| 43.5 GHz to 47 GHz | -2                                      | -2                                    | -2     | 4                                       | 4                                     | 5      |
| 47 GHz to 50 GHz   | -15                                     | -15                                   | -15    | -7                                      | -7                                    | -6     |

<sup>1</sup> In Filtered Mode, the signal path goes through filters to minimize harmonics below 3.2 GHz. In Hi Pwr Mode, the signal bypasses the filters to maximize output power.

**Table 8d. Maximum Leveled Power - Option 224 - Source 2**

| Description        | Specification (dBm)                                 |   |                   | Typical (dBm)                                      |  |                   |
|--------------------|---|---|-------------------|--|--|-------------------|
|                    | Source 2,<br>Out 1<br>Filtered<br>Mode <sup>1</sup> | Source 2,<br>Out 1<br>Hi Pwr<br>Mode <sup>1</sup> | Source 2<br>Out 2 | Source 2<br>Out 1<br>Filtered<br>Mode <sup>1</sup> | Source 2<br>Out 1<br>Hi Pwr<br>Mode <sup>1</sup> | Source 2<br>Out 2 |
| 10 MHz to 50 MHz   | 4   | 13  | 13                | 10   | 18   | 17                |
| 50 MHz to 500 MHz  | 8   | 18  | 15                | 11   | 20   | 19                |
| 500 MHz to 1 GHz   | 8   | 16  | 13                | 11   | 19   | 17                |
| 1 GHz to 2 GHz     | 8   | 13  | 13                | 11   | 17   | 17                |
| 2 GHz to 3.2 GHz   | 8   | 11  | 13                | 11   | 14   | 17                |
| 3.2 GHz to 10 GHz  | 14  | 14  | 16                | 18   | 18   | 19                |
| 10 GHz to 16 GHz   | 12  | 12  | 13                | 16   | 16   | 16                |
| 16 GHz to 26.5 GHz | 14  | 14  | 14                | 18   | 18   | 18                |
| 26.5 GHz to 30 GHz | 14  | 14  | 14                | 18   | 18   | 19                |
| 30 GHz to 32 GHz   | 13  | 13  | 14                | 17   | 17   | 19                |
| 32 GHz to 35 GHz   | 14  | 14  | 14                | 18   | 18   | 19                |
| 35 GHz to 43.5 GHz | 11  | 11  | 12                | 15   | 15   | 15                |
| 43.5 GHz to 47 GHz | 7   | 7   | 8                 | 13   | 13   | 13                |
| 47 GHz to 50 GHz   | -5  | -5  | -5                | 2  | 2  | 5                 |

<sup>1</sup> In Filtered Mode, the signal path goes through filters to minimize harmonics below 3.2 GHz. In Hi Pwr Mode, the signal bypasses the filters to maximize output power.

Figure 9. Block Diagram: N5244A and N5245A Option 224

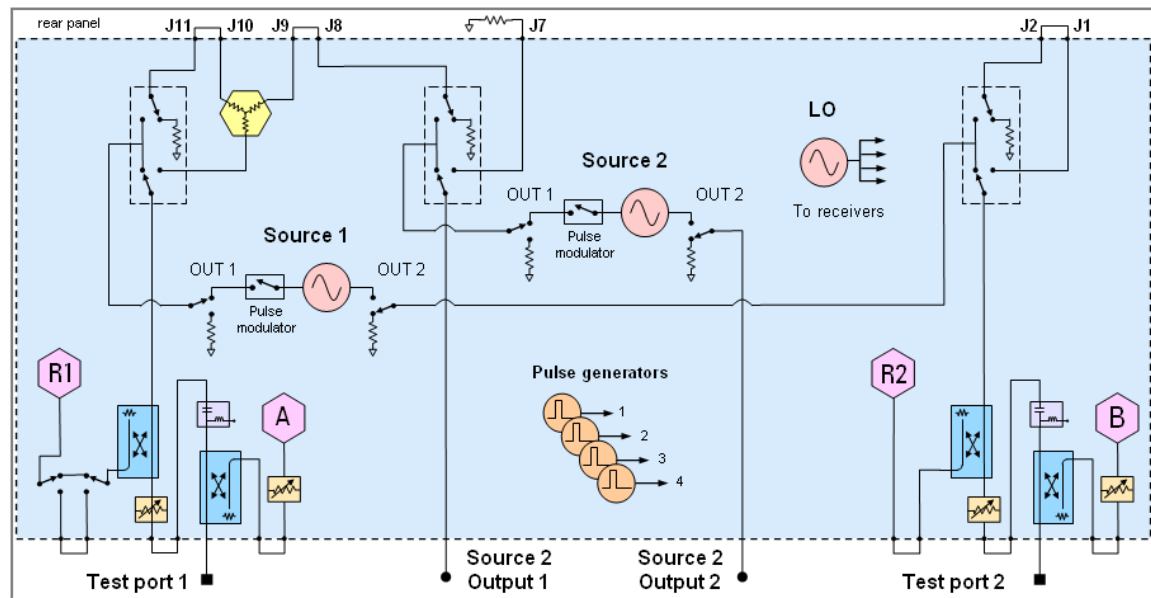
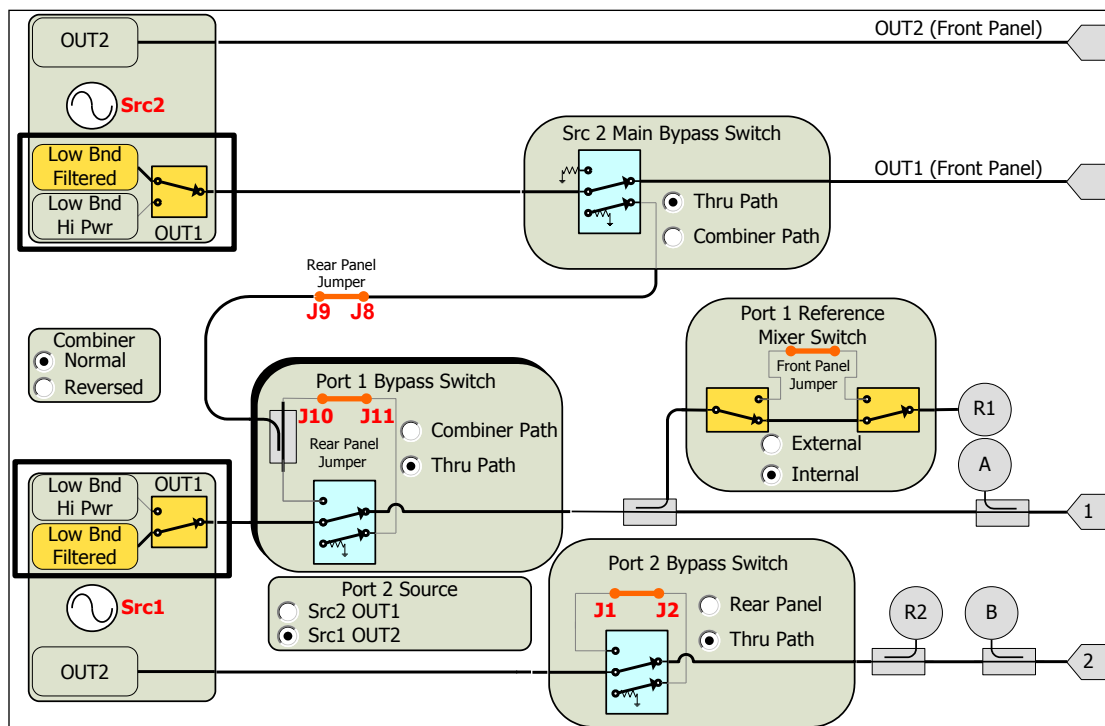


Figure 10. Path Configuration Diagram, N5244A and N5245A Option 224



**Table 8e. Maximum Levelled Power - Option 423**

| Description        | Specification (dBm)                                       |   |                          | Typical (dBm)   |   |                          |
|--------------------|---|---|--------------------------|---|---|--------------------------|
|                    | Port 1 or 3 <sup>1</sup><br>Filtered<br>Mode <sup>2</sup> | Port 1 or 3 <sup>1</sup><br>Hi Pwr<br>Mode <sup>2</sup> | Port 2 or 4 <sup>1</sup> | Port 1 or 3 <sup>1</sup><br>Filtered<br>Mode <sup>2</sup> | Port 1 or 3 <sup>1</sup><br>Hi Pwr<br>Mode <sup>2</sup> | Port 2 or 4 <sup>1</sup> |
| 10 MHz to 50 MHz   | 4   | 11  | 10                       | 11  | 18  | 19                       |
| 50 MHz to 500 MHz  | 8   | 13  | 13                       | 11  | 18  | 19                       |
| 500 MHz to 1 GHz   | 8   | 13  | 13                       | 10  | 18  | 16                       |
| 1 GHz to 2 GHz     | 8   | 13  | 13                       | 10  | 16  | 16                       |
| 2 GHz to 3.2 GHz   | 8   | 10  | 13                       | 10  | 13  | 16                       |
| 3.2 GHz to 10 GHz  | 13  | 13  | 13                       | 16  | 16  | 16                       |
| 10 GHz to 16 GHz   | 11  | 11  | 11                       | 13  | 13  | 13                       |
| 16 GHz to 26.5 GHz | 10  | 10  | 10                       | 13  | 13  | 13                       |
| 26.5 GHz to 30 GHz | 9   | 9   | 9                        | 13  | 13  | 13                       |
| 30 GHz to 32 GHz   | 7   | 7   | 7                        | 11  | 11  | 11                       |
| 32 GHz to 35 GHz   | 9   | 9   | 9                        | 13  | 13  | 13                       |
| 35 GHz to 43.5 GHz | 4   | 4   | 4                        | 8   | 8   | 8                        |
| 43.5 GHz to 47 GHz | -2  | -2  | -2                       | 4   | 4   | 5                        |
| 47 GHz to 50 GHz   | -15   | -15   | -15                      | -7  | -7  | -6                       |

<sup>1</sup> Either port can be used as the source port.

<sup>2</sup> In Filtered Mode, the signal path goes through filters to minimize harmonics below 3.2 GHz. In Hi Pwr Mode, the signal bypasses the filters to maximize output power.

**Table 8f. Maximum Leveled Power - Option 224 or 423**

| Description        | Typical (dBm)  |  |  |  |
|--------------------|--|--|--|--|
|                    | Source 1, Port 1<br>Combine Mode<br>Filtered Mode <sup>1</sup> | Source 1, Port 1<br>Combine Mode<br>Hi Pwr Mode <sup>1</sup> | Source 2, Port 1<br>Combine Mode<br>Filtered Mode <sup>1</sup> | Source 2, Port 1<br>Combine Mode<br>Hi Pwr Mode <sup>1</sup> |
| 10 MHz to 50 MHz   | 4  | 11   | 5  | 11   |
| 50 MHz to 500 MHz  | 4  | 11   | 4  | 11   |
| 500 MHz to 1 GHz   | 4  | 11   | 4  | 11   |
| 1 GHz to 2 GHz     | 4  | 9  | 4  | 8  |
| 2 GHz to 3.2 GHz   | 4  | 5  | 4  | 5  |
| 3.2 GHz to 10 GHz  | 8  | 8  | 7  | 7  |
| 10 GHz to 16 GHz   | 4  | 4  | 4  | 4  |
| 16 GHz to 26.5 GHz | 2  | 2  | 2  | 2  |
| 26.5 GHz to 30 GHz | 1  | 1  | 0  | 0  |
| 30 GHz to 32 GHz   | 1  | 1  | 0  | 0  |
| 32 GHz to 35 GHz   | 1  | 1  | 0  | 0  |
| 35 GHz to 43.5 GHz | -4   | -4   | -5   | -5   |
| 43.5 GHz to 47 GHz | -8   | -8   | -10  | -10  |
| 47 GHz to 50 GHz   | -20  | -20  | -24  | -24  |

<sup>1</sup> In Filtered Mode, the signal path goes through filters to minimize harmonics below 3.2 GHz. In Hi Pwr Mode, the signal bypasses the filters to maximize output power.

Figure 11. Block Diagram: N5244A and N5245A Option 423

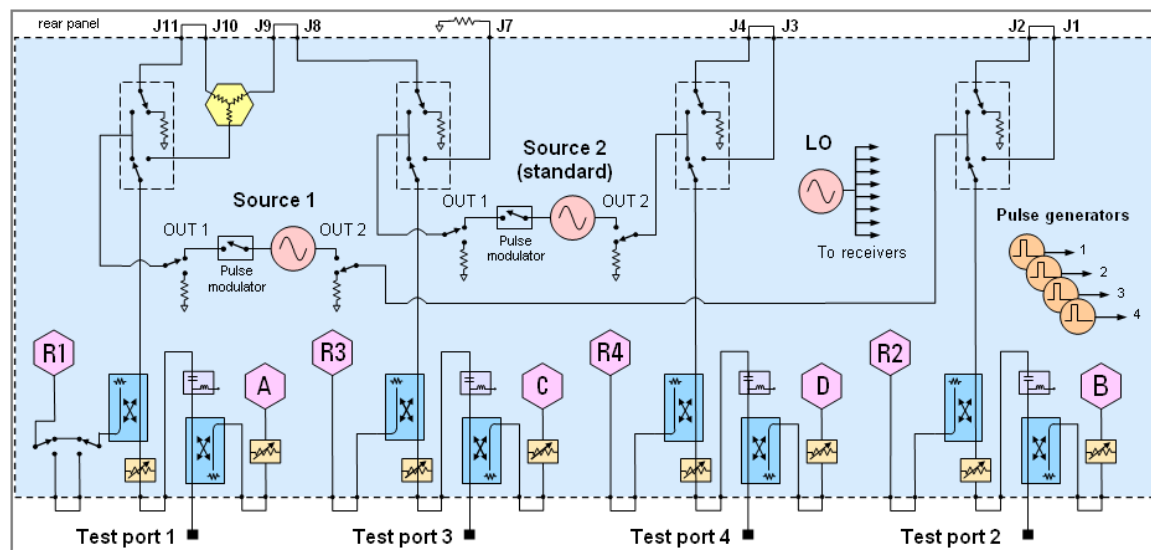
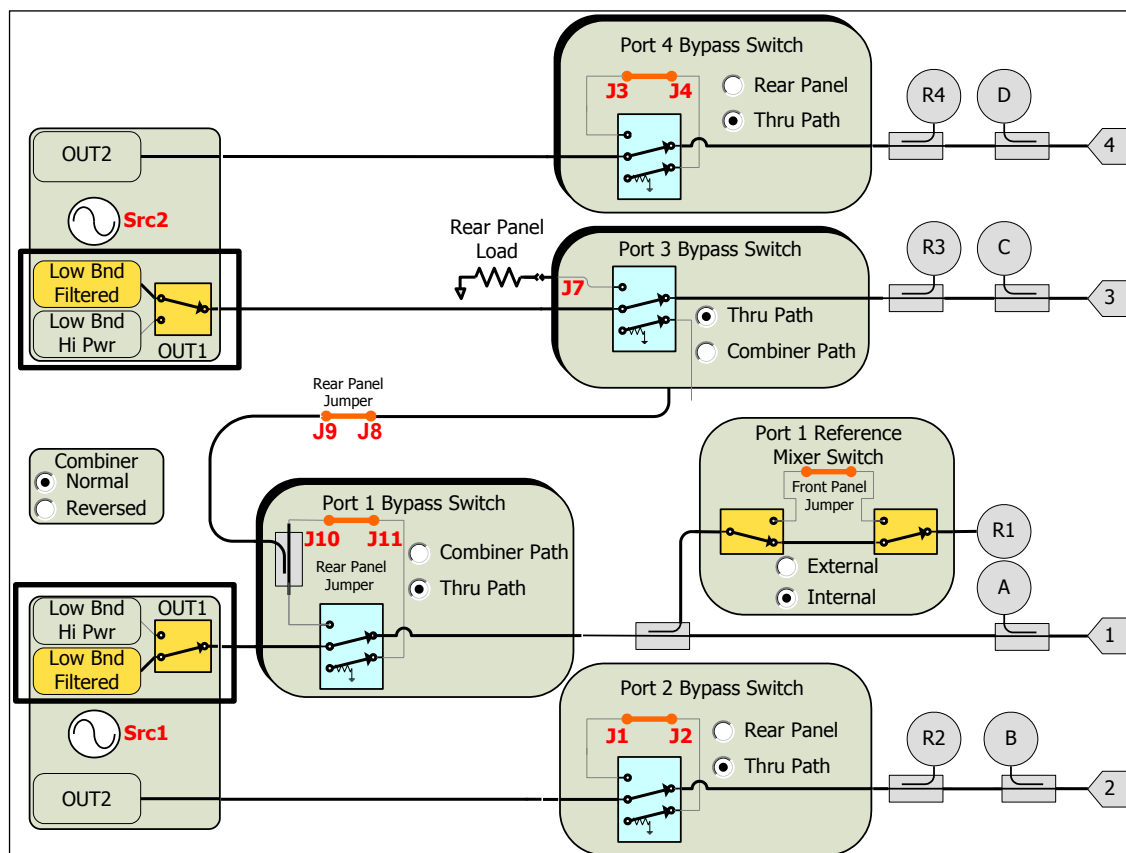


Figure 12. Path Configuration Diagram, N5244A and N5245A Option 423



**Table 9a. Power Level Accuracy - All Options**

| Description          | Specification (dB)            |                                    | Typical (dB)                  |                                    |
|----------------------|-------------------------------|------------------------------------|-------------------------------|------------------------------------|
|                      | Ports 1, 2, 3, 4 <sup>1</sup> | Source 2, Out 1<br>Source 2, Out 2 | Ports 1, 2, 3, 4 <sup>1</sup> | Source 2, Out 1<br>Source 2, Out 2 |
| 10 MHz to 50 MHz     | +/- 1.0 dB                    | +/- 2.0 dB                         | +/- 0.27 dB                   | +/- 0.30 dB                        |
| 50 MHz to 1 GHz      | +/- 1.0 dB                    | +/- 2.0 dB                         | +/- 0.24 dB                   | +/- 0.26 dB                        |
| 1 GHz to 3.2 GHz     | +/- 1.2 dB                    | +/- 2.0 dB                         | +/- 0.33 dB                   | +/- 0.20 dB                        |
| 3.2 GHz to 13.5 GHz  | +/- 1.5 dB                    | +/- 2.0 dB                         | +/- 0.33 dB                   | +/- 0.20 dB                        |
| 13.5 GHz to 20 GHz   | +/- 1.5 dB                    | +/- 2.5 dB                         | +/- 0.36 dB                   | +/- 0.52 dB                        |
| 20 GHz to 26.5 GHz   | +/- 2.0 dB                    | +/- 2.5 dB                         | +/- 0.47 dB                   | +/- 0.44 dB                        |
| 26.5 GHz to 43.5 GHz | +/- 3.0 dB                    | +/- 3.5 dB                         | +/- 0.25 dB                   | +/- 0.27 dB                        |
| 43.5 GHz to 50 GHz   | +/- 3.5 dB                    | +/- 3.5 dB                         | +/- 0.97 dB                   | +/- 0.82 dB                        |

<sup>1</sup>Any port can be used as the source port. Source in filtered mode where applicable.

**Table 9b. Power Level Linearity - All Options**

| Description        | Specification (dB)                              |   |  |
|--------------------|---|---|--|
|                    | Port 1 or 3 <sup>1</sup><br>-25dBm ≤ P < -20dBm | Port 1 or 3 <sup>1</sup><br>-20dBm ≤ P < -15dBm | Port 1 or 3 <sup>1</sup><br>P ≥ -15dBm |
| 10 MHz to 43.5 GHz | +/- 1.5 dB                                      | +/- 1.5 dB                                      | +/- 1.5 dB                             |
| 43.5 GHz to 50 GHz | +/- 1.5 dB                                      | +/- 1.5 dB                                      | +/- 1.5 dB                             |

<sup>1</sup> Either port can be used as the source port. Source in filtered mode.

**Table 9c. Power Level Linearity - All Options**

| Description        | Specification (dB)                              |   |  |
|--------------------|---|---|--|
|                    | Port 2 or 4 <sup>1</sup><br>-25dBm ≤ P < -20dBm | Port 2 or 4 <sup>1</sup><br>-20dBm ≤ P < -15dBm | Port 2 or 4 <sup>1</sup><br>P ≥ -15dBm |
| 10 MHz to 50 MHz   | +/- 2.0 dB                                      | +/- 1.5 dB                                      | +/- 1.5 dB                             |
| 50 MHz to 43.5 GHz | +/- 2.0 dB                                      | +/- 1.5 dB                                      | +/- 1.5 dB                             |
| 43.5 GHz to 50 GHz | +/- 2.0 dB                                      | +/- 1.5 dB                                      | +/- 1.5 dB                             |

<sup>1</sup> Either port can be used as the source port.

**Table 9d. Power Level Linearity - Option 224**

| Description        | Specification (dB)                         |  |                               |
|--------------------|--|--|-------------------------------|
|                    | Source 2, Out 1 <sup>1</sup><br>P ≥ -15dBm | Source 2, Out 2<br>-15dBm ≤ P < -10dBm | Source 2, Out 2<br>P ≥ -10dBm |
| 10 MHz to 43.5 GHz | +/- 1.0 dB                                 | +/- 1.0 dB                             | +/- 1.0 dB                    |
| 43.5 GHz to 50 GHz | +/- 1.0 dB                                 | +/- 1.0 dB                             | +/- 1.0 dB                    |

<sup>1</sup>Source in filtered mode.

**Table 10a. Power Sweep Range - Option 200 or 400**

| Description        | Specification (dB)       |                          | Typical (dB)             |                          |
|--------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|                    | Port 1 or 3 <sup>1</sup> | Port 2 or 4 <sup>1</sup> | Port 1 or 3 <sup>1</sup> | Port 2 or 4 <sup>1</sup> |
| 10 MHz to 50 MHz   | 37                       | 37                       | 44                       | 44                       |
| 50 MHz to 500 MHz  | 38                       | 38                       | 45                       | 46                       |
| 500 MHz to 1 GHz   | 38                       | 38                       | 45                       | 43                       |
| 1 GHz to 2 GHz     | 38                       | 38                       | 43                       | 43                       |
| 2 GHz to 3.2 GHz   | 35                       | 38                       | 41                       | 43                       |
| 3.2 GHz to 10 GHz  | 38                       | 38                       | 44                       | 44                       |
| 10 GHz to 16 GHz   | 38                       | 38                       | 43                       | 42                       |
| 16 GHz to 26.5 GHz | 38                       | 38                       | 42                       | 43                       |
| 26.5 GHz to 30 GHz | 37                       | 37                       | 43                       | 43                       |
| 30 GHz to 32 GHz   | 36                       | 36                       | 42                       | 42                       |
| 32 GHz to 35 GHz   | 37                       | 37                       | 43                       | 43                       |
| 35 GHz to 43.5 GHz | 34                       | 34                       | 40                       | 40                       |
| 43.5 GHz to 47 GHz | 30                       | 30                       | 37                       | 37                       |
| 47 GHz to 50 GHz   | 17                       | 17                       | 26                       | 26                       |

<sup>1</sup> Either port can be used as the source port. Source in Hi Pwr mode where applicable.



**Table 10b. Power Sweep Range - Option 219 or 419**

| Description        | Specification (dB)       |                          | Typical (dB)             |                          |
|--------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|                    | Port 1 or 3 <sup>1</sup> | Port 2 or 4 <sup>1</sup> | Port 1 or 3 <sup>1</sup> | Port 2 or 4 <sup>1</sup> |
| 10 MHz to 50 MHz   | 34                       | 37                       | 46                       | 44                       |
| 50 MHz to 500 MHz  | 38                       | 38                       | 47                       | 47                       |
| 500 MHz to 1 GHz   | 38                       | 38                       | 45                       | 45                       |
| 1 GHz to 2 GHz     | 37                       | 38                       | 44                       | 46                       |
| 2 GHz to 3.2 GHz   | 35                       | 38                       | 42                       | 45                       |
| 3.2 GHz to 10 GHz  | 38                       | 38                       | 43                       | 43                       |
| 10 GHz to 16 GHz   | 36                       | 36                       | 40                       | 40                       |
| 16 GHz to 26.5 GHz | 35                       | 35                       | 40                       | 40                       |
| 26.5 GHz to 30 GHz | 34                       | 34                       | 40                       | 40                       |
| 30 GHz to 32 GHz   | 32                       | 32                       | 38                       | 38                       |
| 32 GHz to 35 GHz   | 34                       | 34                       | 40                       | 40                       |
| 35 GHz to 43.5 GHz | 29                       | 29                       | 35                       | 35                       |
| 43.5 GHz to 47 GHz | 24                       | 24                       | 32                       | 32                       |
| 47 GHz to 50 GHz   | 11                       | 11                       | 19                       | 19                       |

<sup>1</sup> Either port can be used as the source port. Source in Hi Pwr mode where applicable.

**Table 10c. Power Sweep Range - Option 224 or 423**

| Description       | Specification (dB)       |                          | Typical (dB)             |                          |
|-------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|                   | Port 1 or 3 <sup>1</sup> | Port 2 or 4 <sup>1</sup> | Port 1 or 3 <sup>1</sup> | Port 2 or 4 <sup>1</sup> |
| 10 MHz to 50 MHz  | 36                       | 35                       | 45                       | 46                       |
| 50 MHz to 500 MHz | 38                       | 38                       | 45                       | 46                       |
| 500 MHz to 1 GHz  | 38                       | 38                       | 45                       | 43                       |
| 1 GHz to 2 GHz    | 38                       | 38                       | 43                       | 43                       |
| 2 GHz to 3.2 GHz  | 35                       | 38                       | 40                       | 43                       |
| 3.2 GHz to 10 GHz | 38                       | 38                       | 43                       | 43                       |

|                    |    |    |    |    |
|--------------------|----|----|----|----|
| 10 GHz to 16 GHz   | 36 | 36 | 40 | 40 |
| 16 GHz to 26.5 GHz | 35 | 35 | 40 | 40 |
| 26.5 GHz to 30 GHz | 34 | 34 | 40 | 40 |
| 30 GHz to 32 GHz   | 32 | 32 | 38 | 38 |
| 32 GHz to 35 GHz   | 34 | 34 | 40 | 40 |
| 35 GHz to 43.5 GHz | 29 | 29 | 35 | 35 |
| 43.5 GHz to 47 GHz | 23 | 23 | 31 | 32 |
| 47 GHz to 50 GHz   | 10 | 10 | 20 | 21 |

<sup>1</sup> Either port can be used as the source port. Source in Hi Pwr mode where applicable.

**Table 10d. Power Sweep Range - Option 224**

| Description        | Specification (dB)             |                   | Typical (dB)                   |                   |
|--------------------|--------------------------------|-------------------|--------------------------------|-------------------|
|                    | Source 2 <sup>1</sup><br>Out 1 | Source 2<br>Out 2 | Source 2 <sup>1</sup><br>Out 1 | Source 2<br>Out 2 |
| 10 MHz to 50 MHz   | 28                             | 28                | 35                             | 34                |
| 50 MHz to 500 MHz  | 33                             | 30                | 37                             | 36                |
| 500 MHz to 1 GHz   | 31                             | 28                | 36                             | 34                |
| 1 GHz to 2 GHz     | 28                             | 28                | 34                             | 34                |
| 2 GHz to 3.2 GHz   | 26                             | 28                | 31                             | 34                |
| 3.2 GHz to 10 GHz  | 29                             | 31                | 35                             | 36                |
| 10 GHz to 16 GHz   | 27                             | 28                | 33                             | 33                |
| 16 GHz to 26.5 GHz | 29                             | 29                | 35                             | 35                |
| 26.5 GHz to 30 GHz | 29                             | 29                | 35                             | 36                |
| 30 GHz to 32 GHz   | 28                             | 29                | 34                             | 36                |
| 32 GHz to 35 GHz   | 29                             | 29                | 35                             | 36                |
| 35 GHz to 43.5 GHz | 26                             | 27                | 32                             | 32                |
| 43.5 GHz to 47 GHz | 22                             | 23                | 30                             | 30                |
| 47 GHz to 50 GHz   | 10                             | 10                | 19                             | 22                |

<sup>1</sup>Source in Hi Pwr mode where applicable.

**Table 11. Nominal Power (Preset Power)**

| Specification (dBm)           |         |                    |                    | Typical (dBm)                         |                                       |
|-------------------------------|---------|--------------------|--------------------|---------------------------------------|---------------------------------------|
| All Options                   |         | Option 224         |                    | Option 224 or 423                     |                                       |
| Ports 1, 2, 3, 4 <sup>1</sup> |         | Source 2,<br>Out 1 | Source 2,<br>Out 2 | Source 1<br>Port 1<br>Combine<br>Mode | Source 2<br>Port 1<br>Combine<br>Mode |
| N5244A                        | -5 dBm  | -5 dBm             | -5 dBm             | -15 dBm                               | -15 dBm                               |
| N5245A                        | -15 dBm | -5 dBm             | -5 dBm             | -25 dBm                               | -30 dBm                               |

<sup>1</sup> Any port can be used as the source port. Any other port can be used as the receiver port.

**Table 12. Power Resolution and Maximum/Minimum Settable Power**

| Description            | Specification at<br>Ports 1,2,3,4 <sup>1</sup> | Typical at Ports 1,2,3,4 <sup>1</sup> |                      |                      |
|------------------------|--|---------------------------------------|----------------------|----------------------|
|                        |  | All Options                           | Option 200<br>or 400 | Option 219<br>or 419 |
| Power Resolution       | 0.01 dB  | --                                    | --                   | --                   |
| Maximum Settable Power | --   | 30 dBm                                | --                   | --                   |
| Minimum Settable Power | --   | --                                    | -30 dBm              | -95 dBm              |

<sup>1</sup> Any port can be used as the source port.

**Table 13. Harmonics at Max Specified Power - All Options**

See [Table 8a. Maximum Levelled Power](#) - Option 200 or 400 on page 26.

| Description  | Typical (dBc)  |   |
|--|--|---|
|  | Port 1 or 3 <sup>1,2</sup> Source 2 Out 1 <sup>3</sup> | Port 2 or 4 <sup>1</sup> Source 2 Out 2 |
| 2 <sup>nd</sup> and 3 <sup>rd</sup> Harmonics <sup>4</sup> |  |   |
| 10 MHz to 2 GHz  | -51  | -13                                     |
| 2 GHz to 13.5 GHz  | -60  | -21                                     |
| 13.5 GHz to 43.5 GHz                                       | -60  | -60                                     |
| 43.5 GHz to 50 GHz   | -60  | -60                                     |

<sup>1</sup> Any port can be used as the source port.

<sup>2</sup> < 3.2 GHz Filtered Mode

<sup>3</sup> At port 1 max specified power.

<sup>4</sup> Listed frequency is fundamental frequency; test at max specified power

**Table 14. Non-Harmonic Spurs at Nominal Power - All Options**

| Description<br>Offset frequency = 30 kHz to 5 MHz | Typical (dBc) at Ports 1, 2, 3, 4 |
|---|-----------------------------------|
|   | Source 2 Out 1,<br>Source 2 Out 2 |
| 10 MHz to 500 MHz                                 | -50                               |
| 500 MHz to 1GHz                                   | -60                               |
| 1 GHz to 2 GHz                                    | -60                               |
| 2 GHz to 4 GHz                                    | -57                               |
| 4 GHz to 8 GHz                                    | -51                               |
| 8 GHz to 16 GHz                                   | -45                               |
| 16 GHz to 24 GHz                                  | -39                               |
| 24 GHz to 26.5 GHz                                | -39                               |
| 26.5 GHz to 32 GHz                                | -39                               |
| 32 GHz to 43.5 GHz                                | -31                               |
| 43.5 GHz to 50 GHz                                | -31                               |

**Table 15. Phase Noise - All Options**

| Description        | Typical (dBc/Hz)                                 |               |                |              |
|--------------------|--|---------------|----------------|--------------|
|                    | Ports 1, 2, 3, 4, Source 2 Out 1, Source 2 Out 2 |               |                |              |
|                    | 1 kHz Offset                                     | 10 kHz Offset | 100 kHz Offset | 1 MHz Offset |
| 10 MHz to 500 MHz  | -85  | -85           | -85            | -120         |
| 500 MHz to 1 GHz   | -105   | -115          | -110           | -127         |
| 1 GHz to 2 GHz     | -100   | -110          | -105           | -121         |
| 2 GHz to 4 GHz     | -95  | -105          | -100           | -115         |
| 4 GHz to 8 GHz     | -89  | -100          | -94            | -110         |
| 8 GHz to 16 GHz    | -83  | -94           | -88            | -105         |
| 16 GHz to 32 GHz   | -77  | -88           | -82            | -99          |
| 32 GHz to 43.5 GHz | -71  | -82           | -76            | -93          |
| 43.5 GHz to 50 GHz | -71  | -82           | -76            | -93          |

## Test Port Input – All Options

Ports 1, 2, 3, 4

**Table 16. Test Port Noise Floor<sup>1</sup> (dBm)**

| Description                     | Specification | Typical |
|---------------------------------|---------------|---------|
| <b>10 Hz IFBW</b>               |               |         |
| 10 MHz to 50 MHz <sup>2</sup>   | -70           | -76     |
| 50 MHz to 100 MHz <sup>2</sup>  | -85           | -91     |
| 100 MHz to 500 MHz <sup>2</sup> | -90           | -98     |
| 500 MHz to 1 GHz                | -106          | -112    |
| 1 GHz to 2 GHz                  | -110          | -114    |
| 2 GHz to 3.2 GHz                | -110          | -114    |
| 3.2 GHz to 10 GHz               | -110          | -114    |
| 10 GHz to 20 GHz                | -111          | -114    |
| 20 GHz to 26.5 GHz              | -111          | -114    |
| 26.5 GHz to 40 GHz              | -108          | -113    |
| 40 GHz to 43.5 GHz              | -109          | -113    |
| 43.5 GHz to 50 GHz              | -107          | -113    |

<sup>1</sup>Total average (rms) noise power calculated as the mean value of a linear magnitude trace expressed in dBm.

<sup>2</sup>May typically be degraded at particular frequencies below 500 MHz due to spurious receiver residuals.

**Table 17. Direct Receiver Access Input Noise Floor<sup>1</sup> (dBm)**

| Description                     | Specification | Typical |
|---------------------------------|---------------|---------|
| 10 MHz to 50 MHz <sup>2</sup>   | -105          | -111    |
| 50 MHz to 100 MHz <sup>2</sup>  | -105          | -111    |
| 100 MHz to 500 MHz <sup>2</sup> | -110          | -118    |
| 500 MHz to 1 GHz                | -127          | -133    |
| 1 GHz to 2 GHz                  | -130          | -134    |
| 2 GHz to 3.2 GHz                | -122          | -126    |

|                    |      |      |
|--------------------|------|------|
| 3.2 GHz to 10 GHz  | -122 | -126 |
| 10 GHz to 20 GHz   | -123 | -126 |
| 20 GHz to 26.5 GHz | -123 | -126 |
| 26.5 GHz to 40 GHz | -118 | -123 |
| 40 GHz to 43.5 GHz | -119 | -123 |
| 43.5 GHz to 50 GHz | -117 | -123 |

<sup>1</sup>Total average (rms) noise power calculated as the mean value of a linear magnitude trace expressed in dBm.

<sup>2</sup> May typically be degraded at particular frequencies below 500 MHz due to spurious receiver residuals.

**Table 18. Test Port Compression at 0.1 dB (dBm) - All Options**

| Description             | Specification | Typical |
|-------------------------|---------------|---------|
| 10 MHz to-10 GHz        | --            | 15      |
| <i>10 GHz to 50 GHz</i> | --            | 13      |

**Table 19. Receiver Compression Test Port Power (dBm) - Ports 1, 2, 3, 4**

| Description                    | Test Port Power     |                     |                     | Receiver compression Magnitude (dB) | Receiver compression Phase (degree) |
|--------------------------------|---------------------|---------------------|---------------------|-------------------------------------|-------------------------------------|
|                                | Options 200 and 400 | Options 219 and 419 | Options 224 and 423 |                                     |                                     |
| 500 MHz to 10 GHz <sup>1</sup> | 13                  | 13                  | 13                  | 0.15                                | 1.5                                 |
| 10 GHz to 13.5 GHz             | 13                  | 11                  | 10                  | 0.15                                | 1.5                                 |
| 13.5 GHz to 20 GHz             | 13                  | 9                   | 9                   | 0.15                                | 1.5                                 |
| 20 GHz to 26.5 GHz             | 13                  | 9                   | 9                   | 0.18                                | 1.5                                 |
| 26.5 GHz to 32 GHz             | 13                  | 9                   | 8                   | 0.18                                | 1.5                                 |
| 32 GHz to 40 GHz               | 9                   | 8                   | 8                   | 0.18                                | 1.5                                 |
| 40 GHz to 43.5 GHz             | 8                   | 8                   | 8                   | 0.18                                | 1.5                                 |
| 43.5 GHz to 45 GHz             | 8                   | 8                   | 8                   | 0.2                                 | 1.5                                 |
| 45 GHz to 47 GHz               | 6                   | 6                   | 6                   | 0.2                                 | 1.5                                 |
| <i>47 GHz to 50 GHz</i>        | 5                   | 1                   | 0                   | 0.2                                 | 1.5                                 |

<sup>1</sup> Test port receiver compression at input levels below 500 MHz is negligible due to coupler roll off in this frequency range.

**Table 20. Trace Noise Magnitude (dB rms)**

Ratioed measurement, nominal power at test port.

| Description          | 1 kHz IFBW<br>Specification | 1 kHz IFBW<br>Typical | 100 kHz IFBW<br>Typical | 600 kHz IFBW<br>Typical |
|----------------------|-----------------------------|-----------------------|-------------------------|-------------------------|
| 10 MHz to 50 MHz     | 0.200                       | 0.08                  | 0.800                   | 2.000                   |
| 50 MHz to 100 MHz    | 0.020                       | 0.013                 | 0.120                   | 0.300                   |
| 100 MHz to 500 MHz   | 0.020                       | 0.005                 | 0.050                   | 0.150                   |
| 500 MHz to 1 GHz     | 0.003                       | 0.002                 | 0.012                   | 0.030                   |
| 1 GHz to 26.5 GHz    | 0.002                       | 0.002                 | 0.011                   | 0.026                   |
| 26.5 GHz to 43.5 GHz | 0.003                       | 0.002                 | 0.011                   | 0.026                   |
| 43.5 GHz to 46 GHz   | 0.004                       | 0.002                 | 0.011                   | 0.026                   |
| 46 GHz to 47 GHz     | 0.004                       | 0.002                 | 0.011                   | 0.026                   |
| 47 GHz to 50 GHz     | 0.004                       | 0.002                 | 0.011                   | 0.026                   |

**Table 21. Trace Noise Phase (deg rms)**

Ratioed measurement, nominal power at test port.

| Description          | 1 kHz IFBW<br>Specification | 1 kHz IFBW<br>Typical | 100 kHz IFBW<br>Typical | 600 kHz IFBW<br>Typical |
|----------------------|-----------------------------|-----------------------|-------------------------|-------------------------|
| 10 MHz to 50 MHz     | 1                           | 0.6                   | 6                       | 14                      |
| 50 MHz to 100 MHz    | 1                           | 0.1                   | 1                       | 1.8                     |
| 100 MHz to 500 MHz   | 0.5                         | 0.035                 | 0.35                    | 1.0                     |
| 500 MHz to 1 GHz     | 0.02                        | 0.009                 | 0.1                     | 0.25                    |
| 1 GHz to 26.5 GHz    | 0.02                        | 0.009                 | 0.08                    | 0.18                    |
| 26.5 GHz to 43.5 GHz | 0.03                        | 0.015                 | 0.08                    | 0.2                     |
| 43.5 GHz to 46 GHz   | 0.03                        | 0.015                 | 0.09                    | 0.2                     |
| 46 GHz to 47 GHz     | 0.03                        | 0.015                 | 0.09                    | 0.2                     |
| 47 GHz to 50 GHz     | 0.03                        | 0.015                 | 0.09                    | 0.2                     |

**Table 22. Reference Level Magnitude**

| Description | Specification |
|-------------|---------------|
| Range       | +/-500 dB     |
| Resolution  | 0.001 dB      |

**Table 23. Reference Level Phase**

| Description | Specification |
|-------------|---------------|
| Range       | +/-500°       |
| Resolution  | 0.01°         |

**Table 24. Stability Magnitude (dB/°C)**

Stability is defined as a ratio measurement made at the test port.

| Description        | Specification | Typical |
|--------------------|---------------|---------|
| 10 MHz to 50 MHz   | --            | 0.02    |
| 50 MHz to 3.2 GHz  | --            | 0.01    |
| 3.2 GHz to 10 GHz  | --            | 0.01    |
| 10 GHz to 16 GHz   | --            | 0.01    |
| 16 GHz to 20 GHz   | --            | 0.015   |
| 20 GHz to 26.5 GHz | --            | 0.015   |
| 26.5 GHz to 32 GHz | --            | 0.02    |
| 32 GHz to 40 GHz   | --            | 0.025   |
| 40 GHz to 43.5 GHz | --            | 0.025   |
| 43.5 GHz to 47 GHz | --            | 0.025   |
| 47 GHz to 50 GHz   | --            | 0.03    |



**Table 25. Stability Phase (°/°C)**

Stability is defined as a ratio measurement made at the test port.

| Description        | Specification | Typical |
|--------------------|---------------|---------|
| 10 MHz to 50 MHz   | --            | 0.3     |
| 50 MHz to 3.2 GHz  | --            | 0.15    |
| 3.2 GHz to 10 GHz  | --            | 0.2     |
| 10 GHz to 16 GHz   | --            | 0.25    |
| 16 GHz to 20 GHz   | --            | 0.3     |
| 20 GHz to 26.5 GHz | --            | 0.4     |
| 26.5 GHz to 32 GHz | --            | 0.55    |
| 32 GHz to 40 GHz   | --            | 0.7     |
| 40 GHz to 43.5 GHz | --            | 0.75    |
| 43.5 GHz to 47 GHz | --            | 0.75    |
| 47 GHz to 50 GHz   | --            | 0.8     |

**Table 26. Damage Input Level**

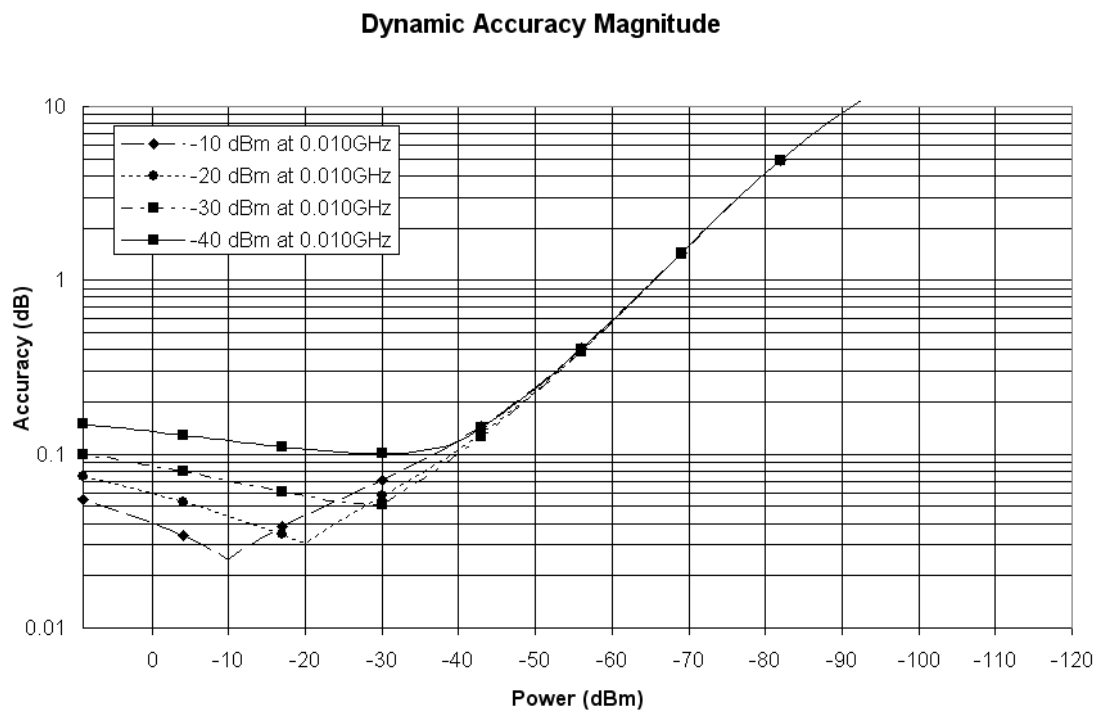
| Description  | Specification        |
|--|----------------------|
| Test Port 1 or 2 or 3 or 4                         | > +30 dBm RF, 40 VDC |
| (Option 224 only) Source 2 Out 1 or Source 2 Out 2 | > +30 dBm RF, 0 VDC  |

Dynamic Accuracy

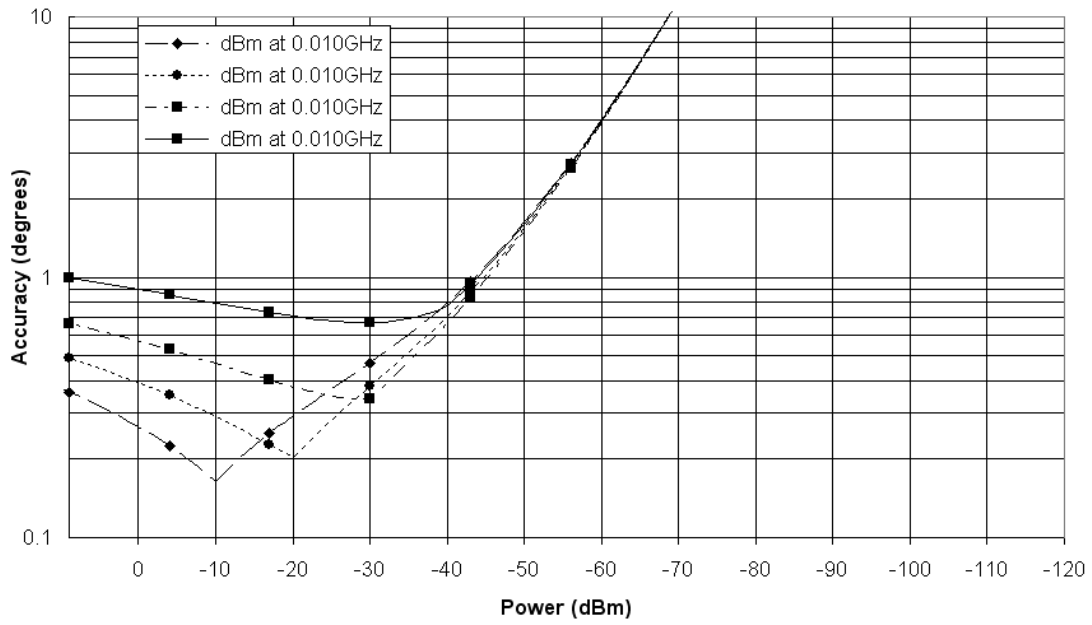
Table 27. Dynamic Accuracy (Specification)

Accuracy of the test port input power reading relative to the reference input power level. <sup>1</sup>

Dynamic Accuracy, 0.010 GHz

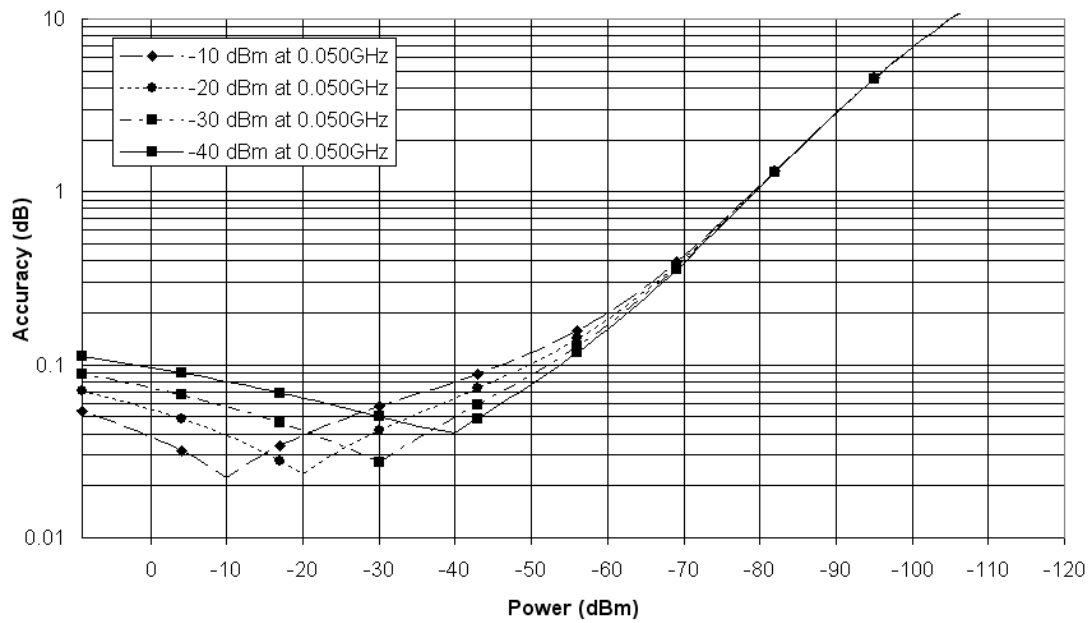


### Dynamic Accuracy Phase

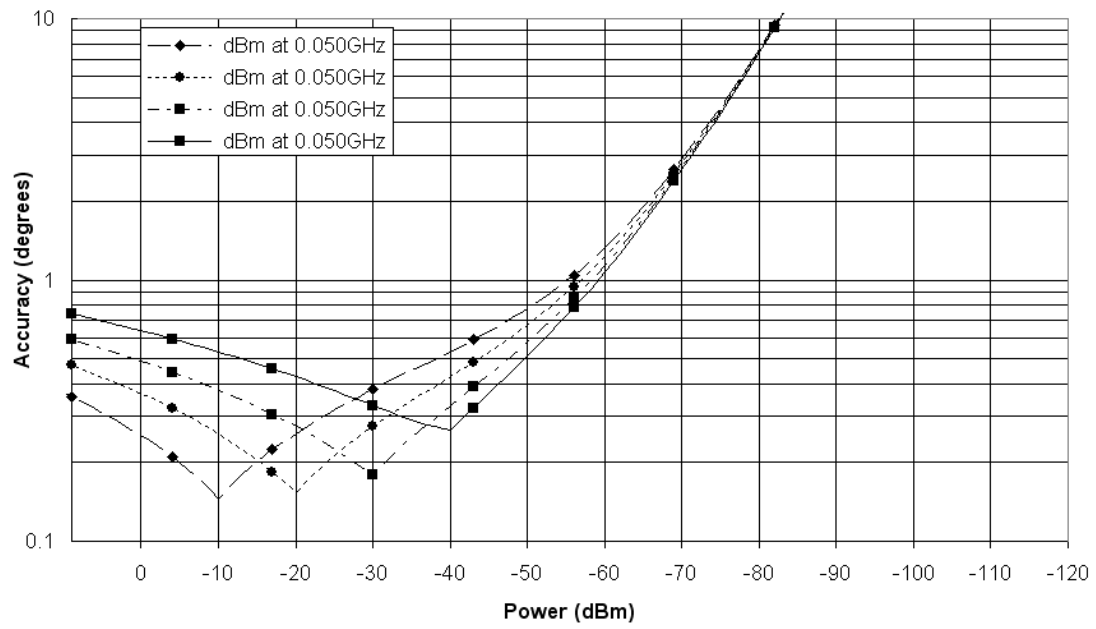


### Dynamic Accuracy, 0.050 GHz

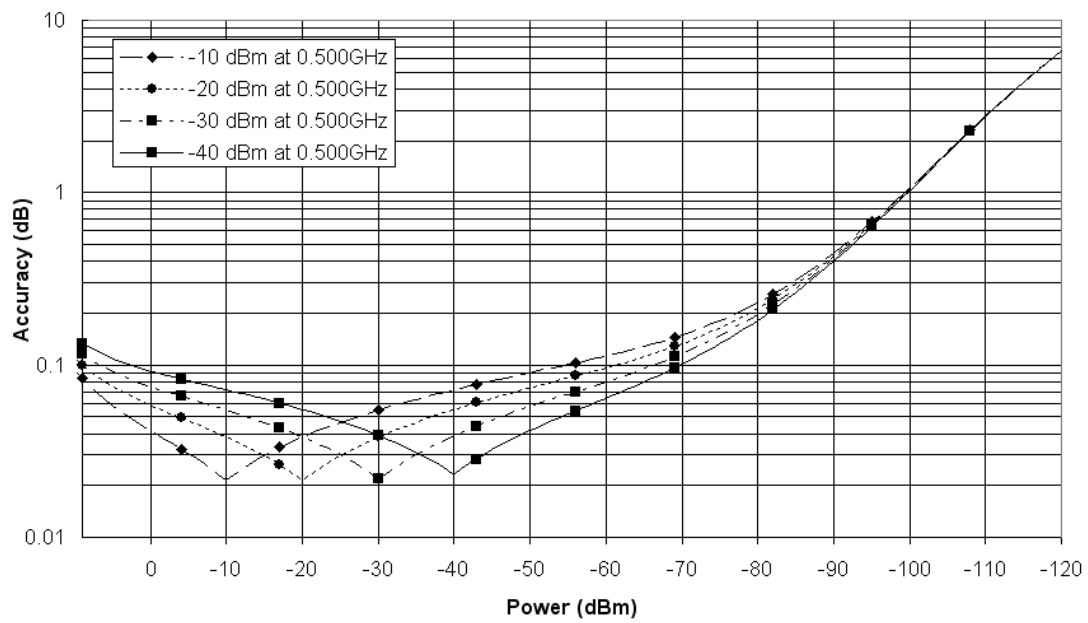
#### Dynamic Accuracy Magnitude



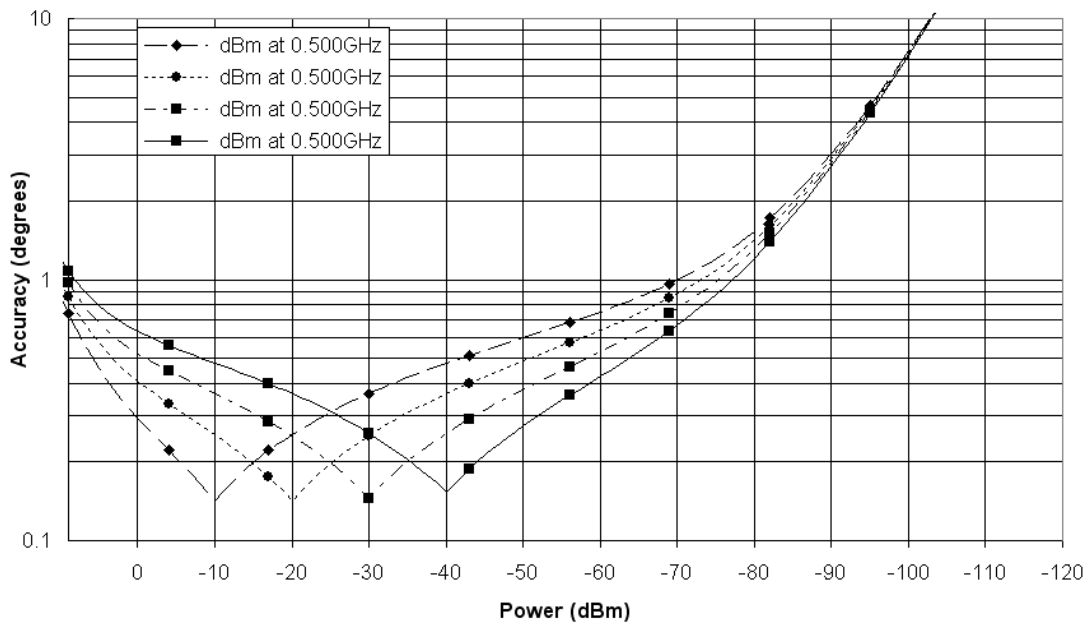
### Dynamic Accuracy Phase



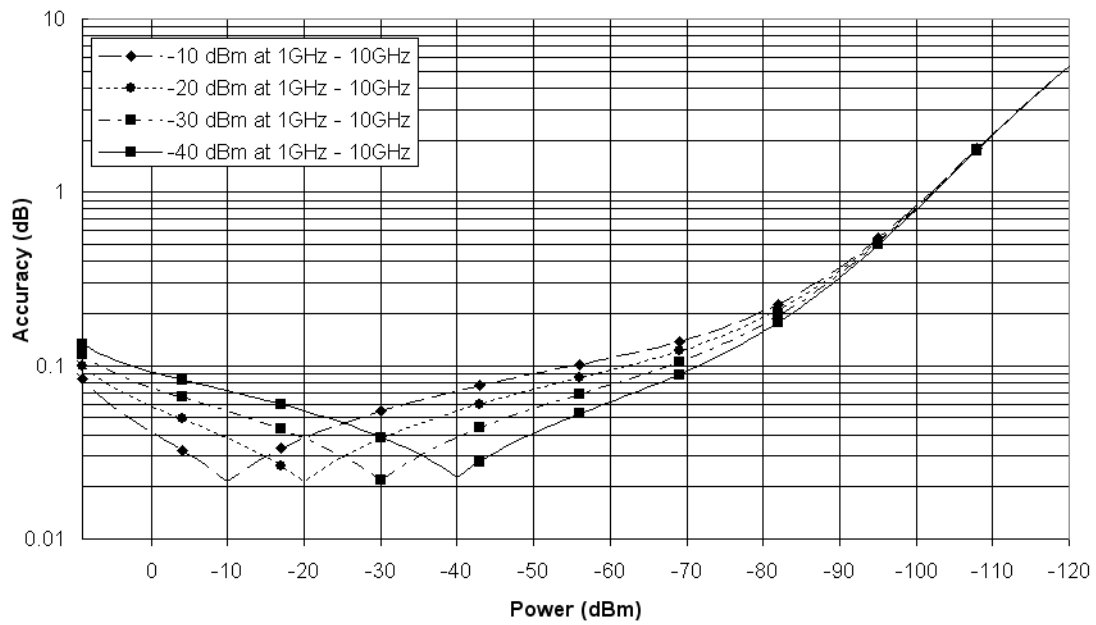
Dynamic Accuracy Magnitude



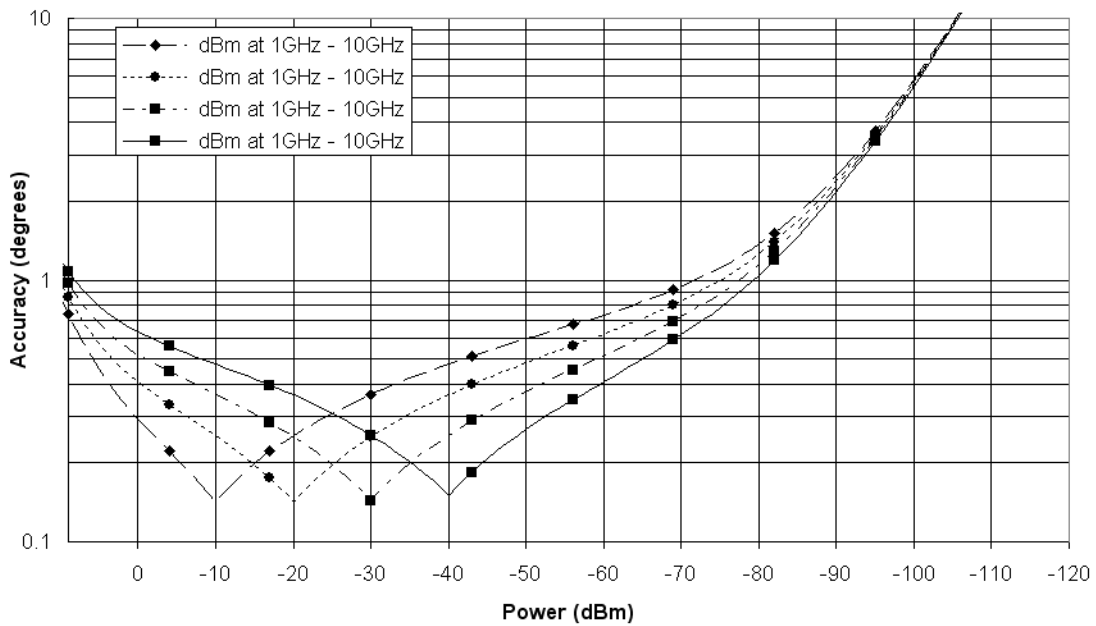
Dynamic Accuracy Phase



Dynamic Accuracy Magnitude

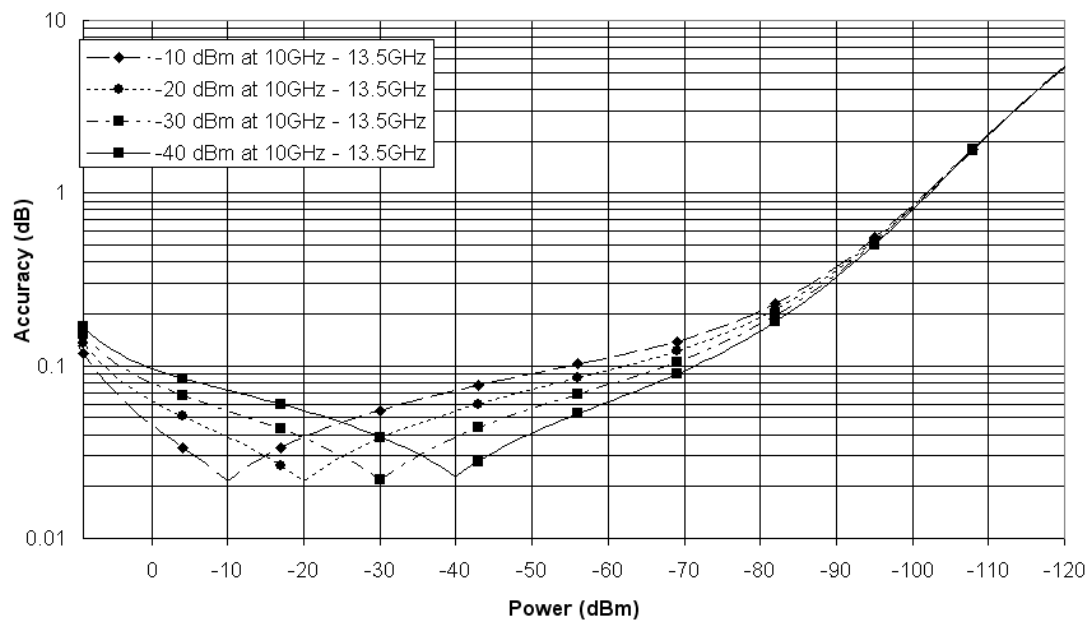


Dynamic Accuracy Phase

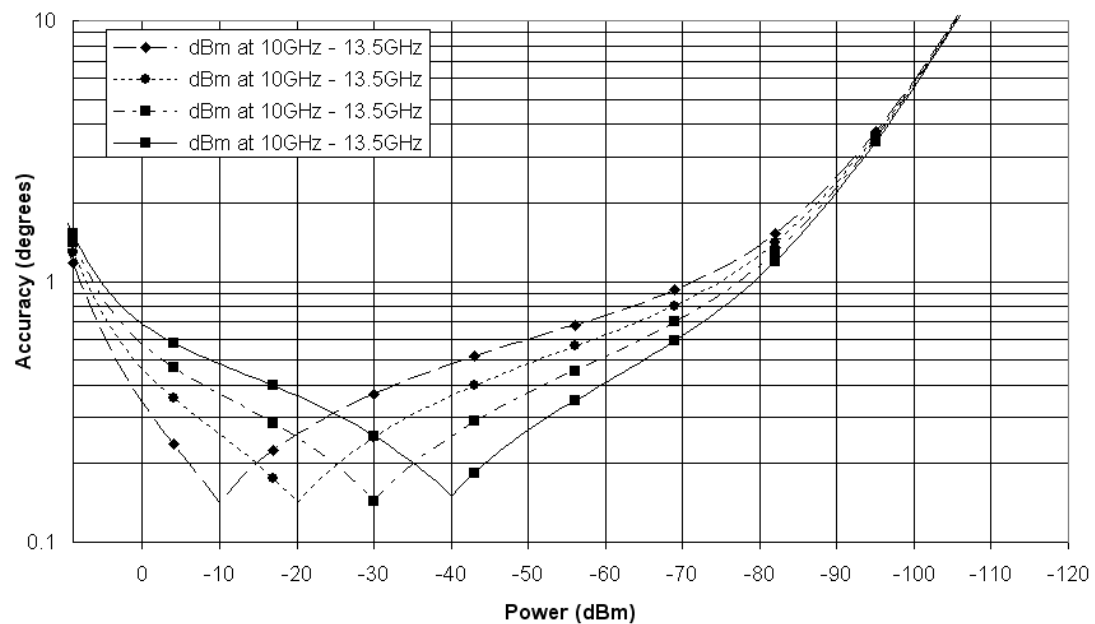


## Dynamic Accuracy, 10 GHz – 13.5 GHz

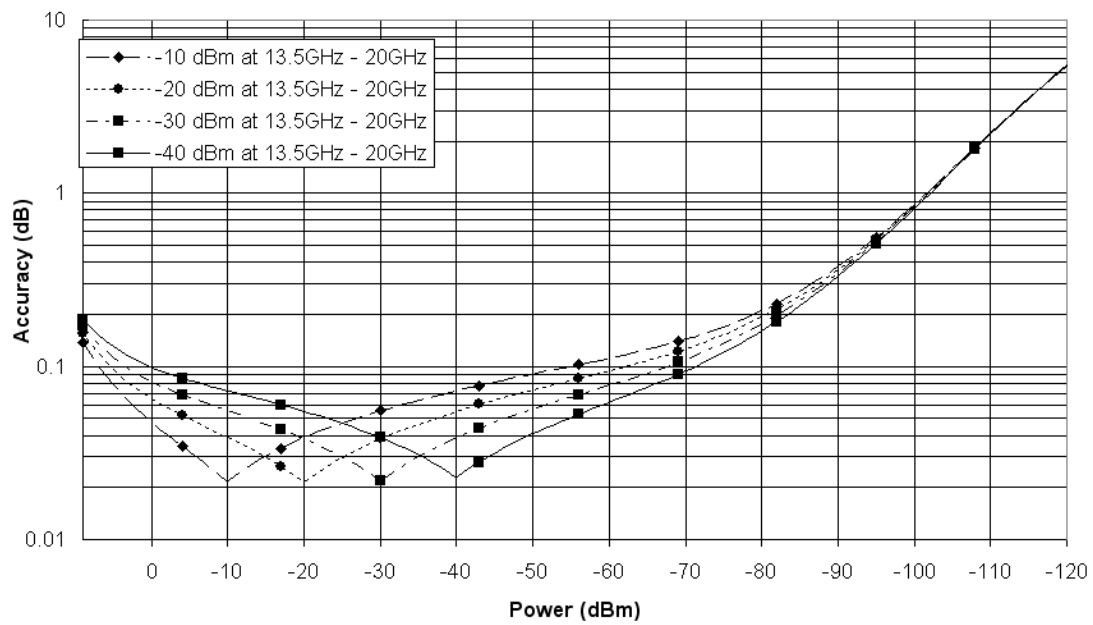
### Dynamic Accuracy Magnitude



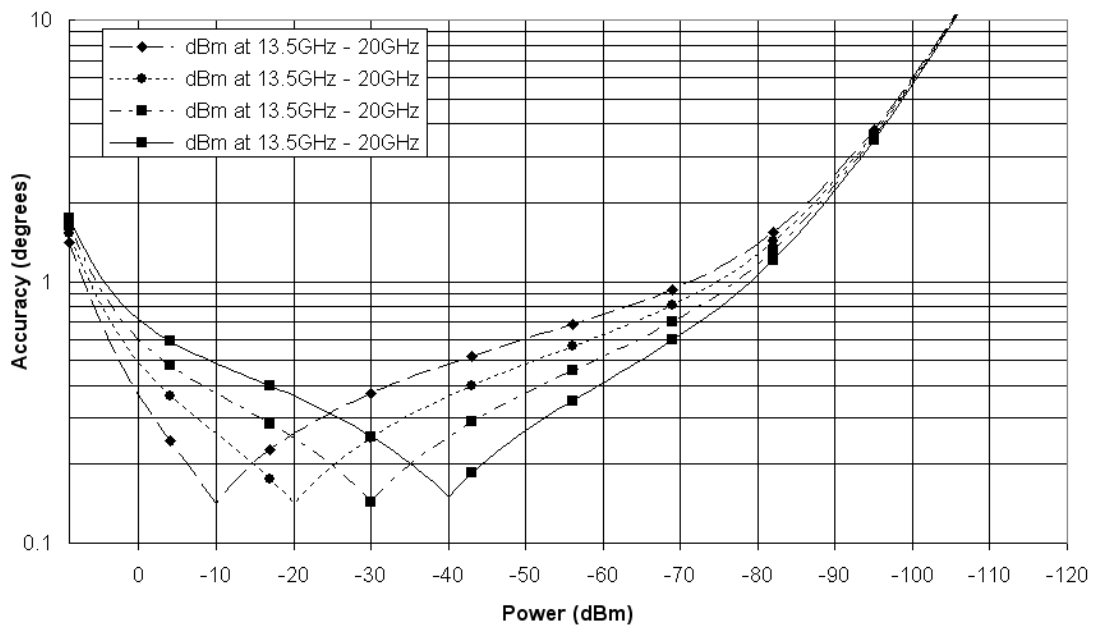
### Dynamic Accuracy Phase



Dynamic Accuracy Magnitude



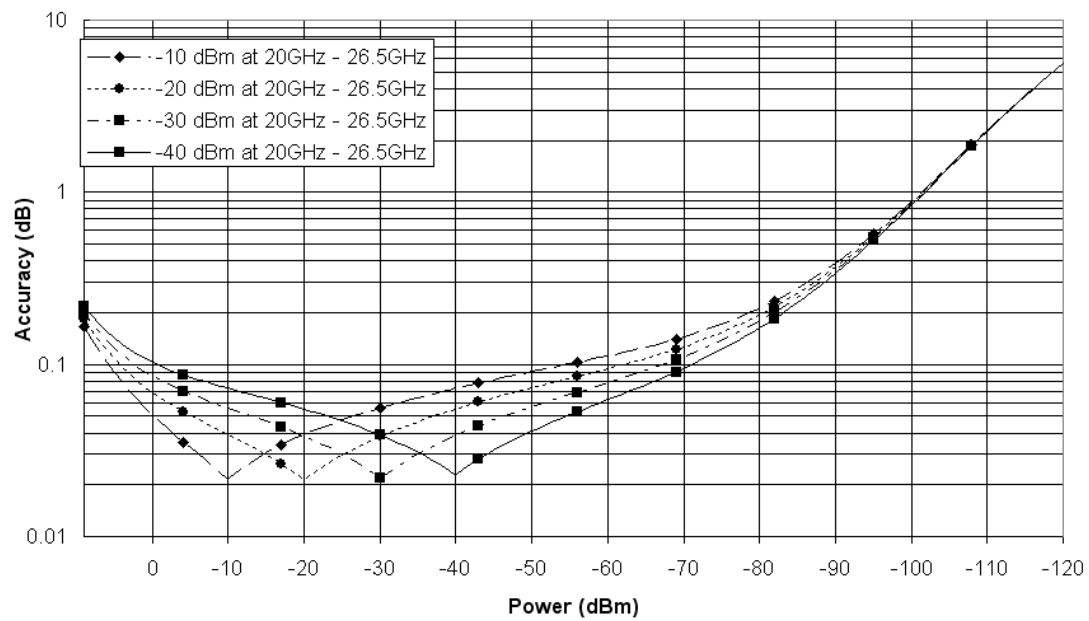
Dynamic Accuracy Phase



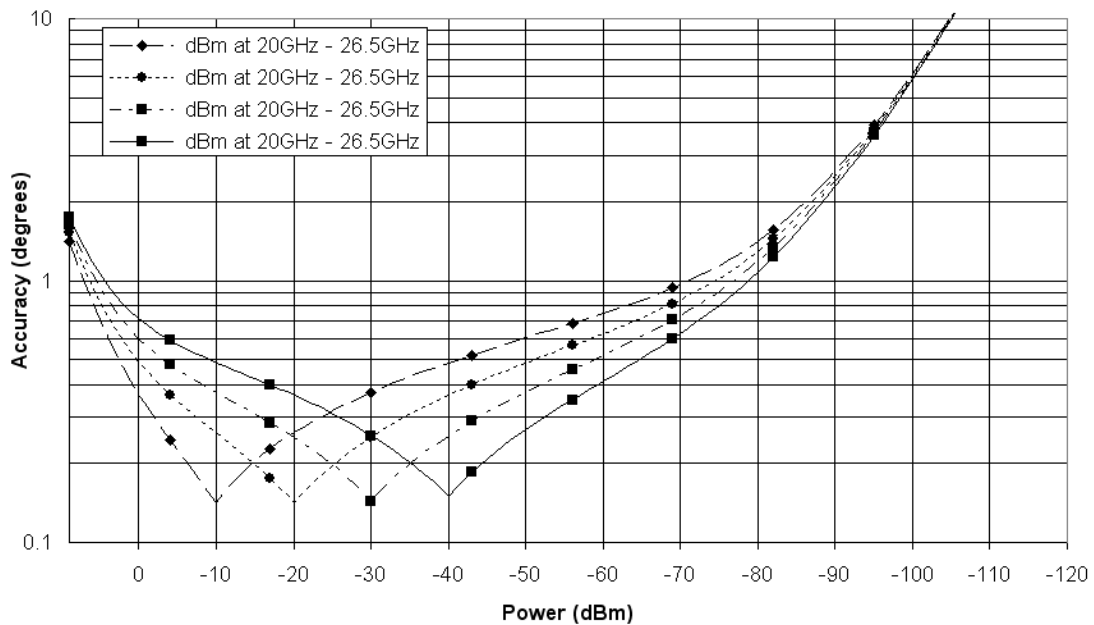


## Dynamic Accuracy, 20 GHz - 26.5 GHz

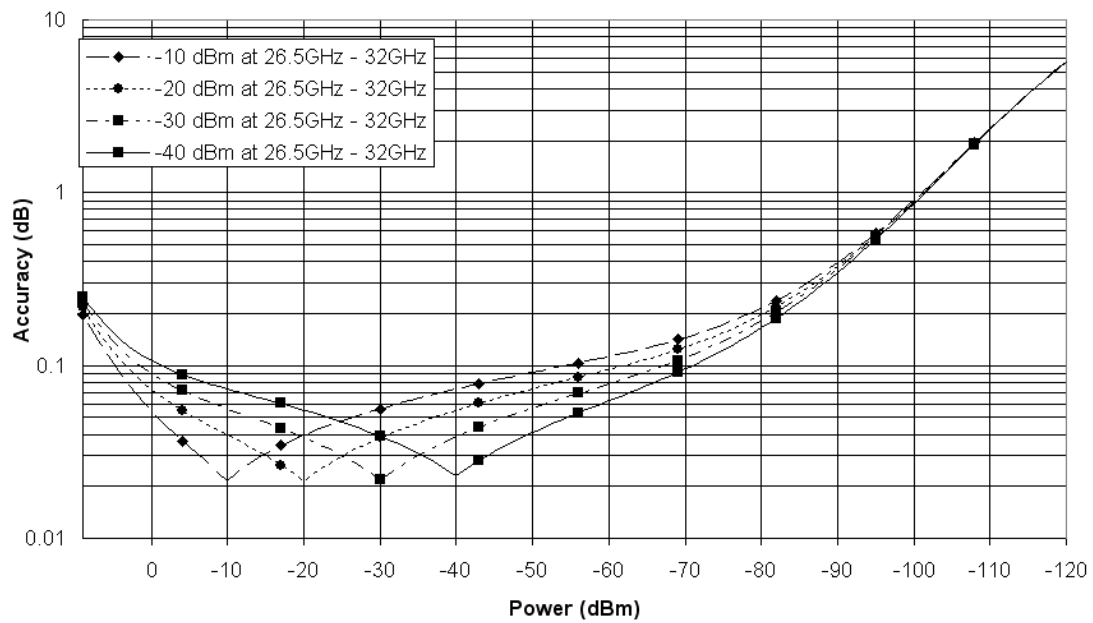
### Dynamic Accuracy Magnitude



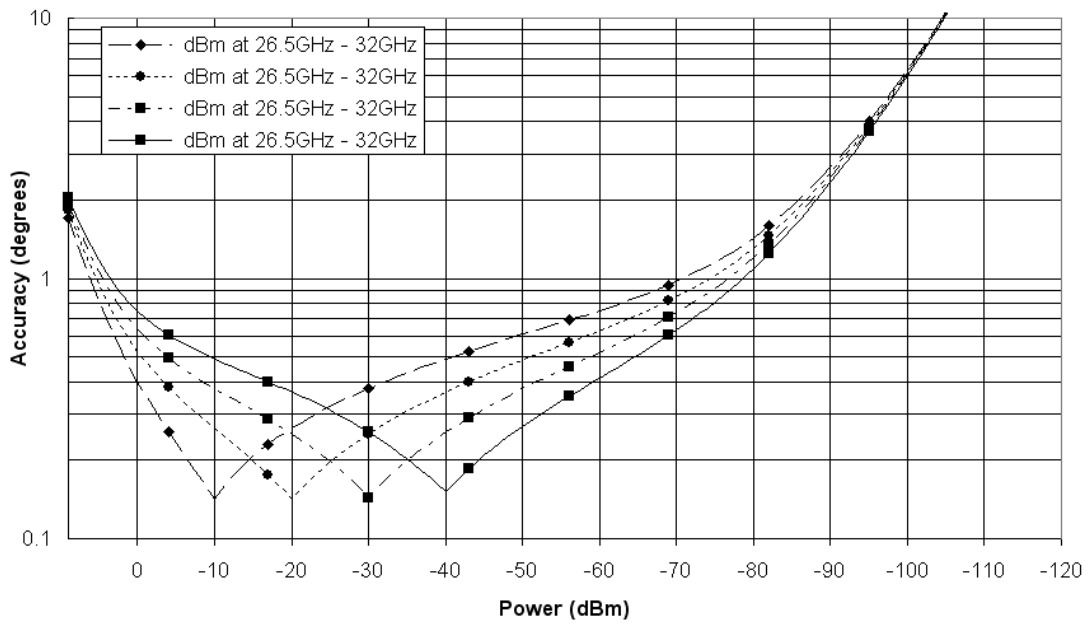
### Dynamic Accuracy Phase



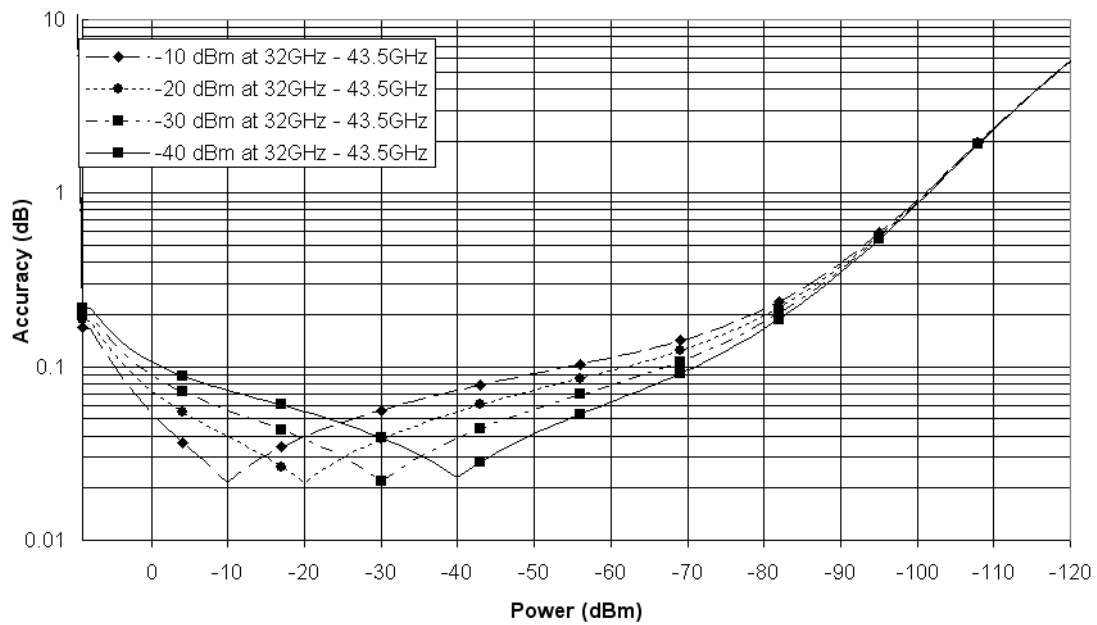
Dynamic Accuracy Magnitude



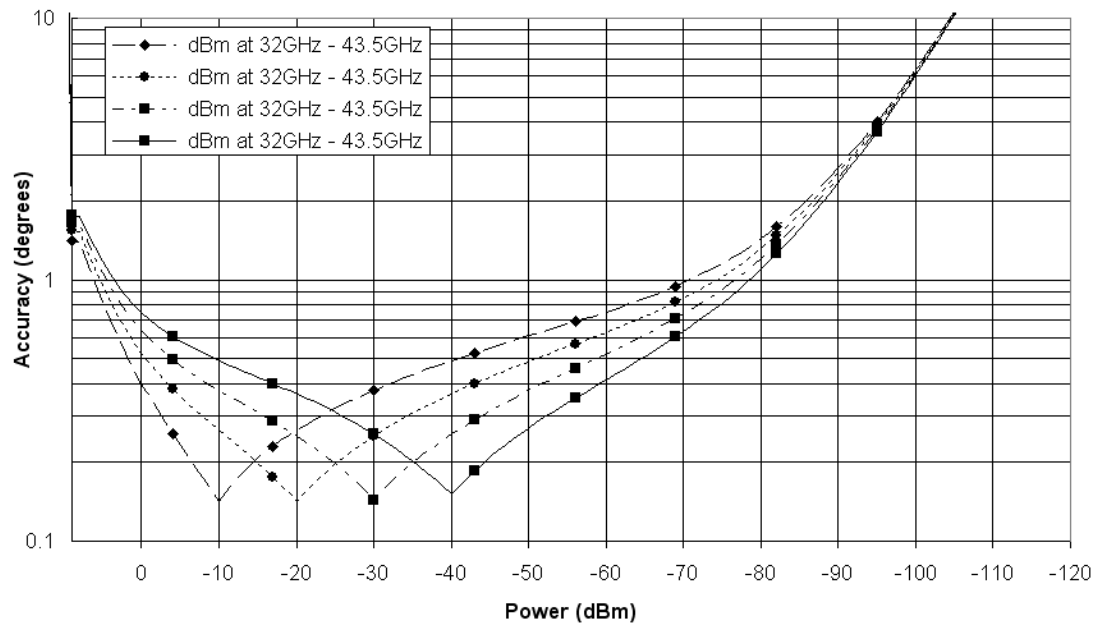
Dynamic Accuracy Phase



Dynamic Accuracy Magnitude

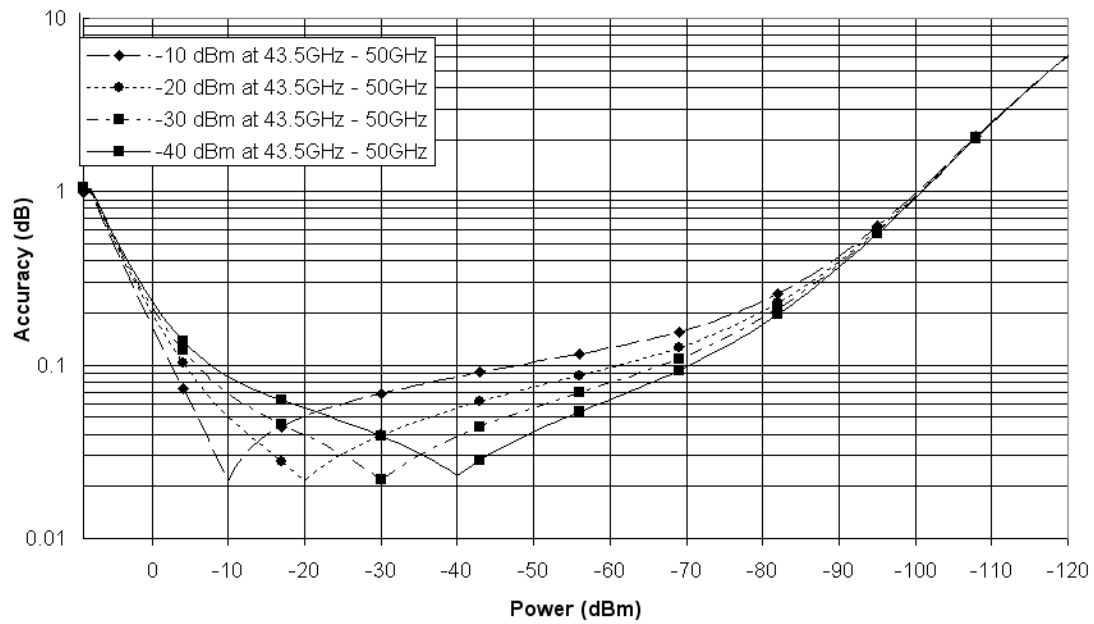


Dynamic Accuracy Phase

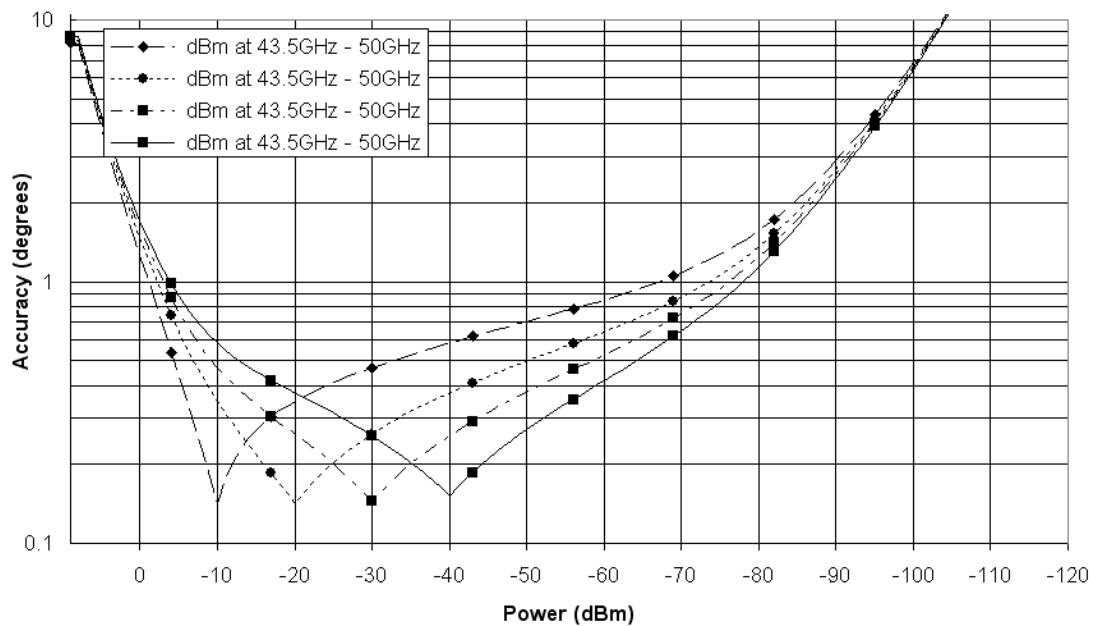


## Dynamic Accuracy, 43.5 to 50 GHz

Dynamic Accuracy Magnitude



Dynamic Accuracy Phase



<sup>1</sup> Dynamic accuracy is verified with the following measurements:

- Compression over frequency
- IF linearity at a single frequency of 1.195 GHz using a reference level of -20 dBm for an input power range of 0 to -120 dBm.

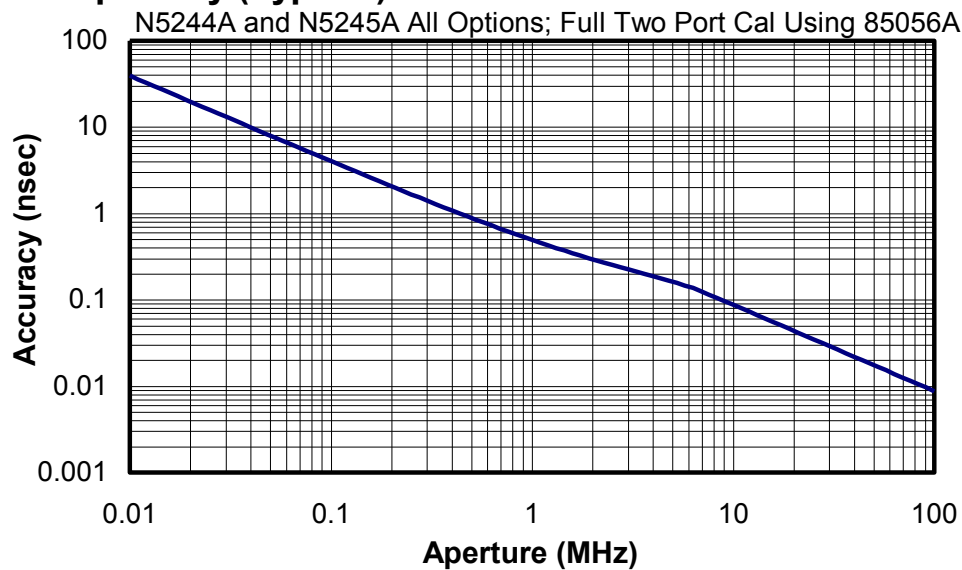
**Table 28. Test Port Input (Group Delay)<sup>1</sup>**

| Description           | Typical Performance  |
|-----------------------|--|
| Aperture (selectable) | (frequency span)/(number of points -1)   |
| Maximum Aperture      | 20% of frequency span  |
| Range                 | 0.5 x (1/minimum aperture)   |
| Maximum Delay         | Limited to measuring no more than 180° of phase change within the minimum aperture.) |
| Accuracy              | See graph below. Char.   |

The following graph shows characteristic group delay accuracy with full 2-port calibration and a 10 Hz IF bandwidth. Insertion loss is assumed to be < 2 dB and electrical length to be ten meters.

For any  $S_{ij}$  Group Delay measurement,  $S_{ii} = 0$ ,  $S_{ij} = 1$ ,  $S_{ji} = 0$ ,  $S_{kl} = 0$  for all  $kl \neq ij$

### Group Delay (Typical)



In general, the following formula can be used to determine the accuracy, in seconds, of specific group delay measurement:

$$\pm \text{Phase Accuracy (deg)} / [360 \times \text{Aperture (Hz)}]$$

Depending on the aperture and device length, the phase accuracy used is either incremental phase accuracy or worst-case phase accuracy.

<sup>1</sup> Group delay is computed by measuring the phase change within a specified frequency step (determined by the frequency span and the number of points per sweep).

## General Information

- [Miscellaneous Information](#)
- [Front Panel](#)
- [Rear Panel](#)
- [Environment and Dimensions](#)

**Table 29. Miscellaneous Information**

| Description               | Supplemental Information                    |
|---------------------------|---|
| System IF Bandwidth Range | 1 Hz to 5 MHz, nominal                      |
| CPU                       | Intel® 2.0 GHz Core 2 Duo® with 4 GByte RAM |
| LXI                       | Class C                                     |

**Table 30. Front Panel Information - All Options**

| Description                             | Typical Performance   |
|---|---|
| <b>RF Connectors</b>                    |   |
| Type                                    | 2.4 mm (male) , 50 ohm, (nominal)   |
| Center Pin Recession                    | 0.002 in. (characteristic)  |
| <b>USB 2.0 Ports - Master (4 ports)</b> |   |
| Standard                                | Compatible with USB 2.0   |
| Connector                               | USB Type-A female   |
| <b>Display</b>                          |   |
| Size                                    | 26.3 cm (10.4 in) diagonal color active matrix LCD; 1024 (horizontal) X 768 (vertical) resolution   |
| Refresh Rate                            | Vertical 60 Hz; Horizontal 46.08 kHz  |
| Pixels                                  | Any of the following would cause a display to be considered faulty: <ul style="list-style-type: none"><li>• A complete row or column consists of “stuck” or “dark” pixels.</li><li>• More than six “stuck on” pixels (but not more than three green) or more than 0.002% of the total pixels are within the LCD specifications.</li><li>• More than twelve “dark” pixels (but no more than seven of the same color) or more than 0.004% of the total pixels are within the LCD specifications.</li><li>• Two or more consecutive "stuck on" pixels or three or more consecutive "dark" pixel (but no more than one set of two consecutive dark pixels)</li><li>• “Stuck on” “dark” pixels are less than 6.5 mm apart (excluding consecutive pixels)</li></ul> |

**Table 30. (Continued) Front Panel Information - All Options**

| <b>Display Range</b>      |                                     |
|---------------------------|-------------------------------------|
| Magnitude                 | +/-2500 dB (at 500 dB/div), max     |
| Phase                     | +/-2500° (at 500 dB/div), max       |
| Polar                     | 10 pUnits, min<br>10,000 Units, max |
| <b>Display Resolution</b> |                                     |
| Magnitude                 | 0.001 dB/div, min                   |
| Phase                     | 0.01°/div, min                      |
| <b>Marker Resolution</b>  |                                     |
| Magnitude                 | 0.001 dB, min                       |
| Phase                     | 0.01°, min                          |
| Polar                     | 10 pUnit, min                       |

**Table 31. Rear Panel Information - All Options**

| <b>Description</b>          | <b>Typical Performance</b>          |
|-----------------------------|-------------------------------------|
| <b>10 MHz Reference In</b>  |                                     |
| Connector                   | BNC, female                         |
| Input Frequency             | 10 MHz $\pm$ 10 ppm                 |
| Input Level                 | -15 dBm to +20 dBm                  |
| Input Impedance             | 200 $\Omega$ , nom.                 |
| <b>10 MHz Reference Out</b> |                                     |
| Connector                   | BNC, female                         |
| Output Frequency            | 10 MHz $\pm$ 1 ppm                  |
| Signal Type                 | Sine Wave                           |
| Output Level                | +10 dBm $\pm$ 4 dB into 50 $\Omega$ |
| Output Impedance            | 50 $\Omega$ , nominal               |
| Harmonics                   | <-40 dBc, typical                   |

**Table 31. (Continued) Rear Panel Information**

| <b>External IF Inputs</b>              |  |
|--|--|
| Function                               | Allows use of external IF signals from remote mixers, bypassing the PNA's first converters |
| Connectors                             | SMA (female); A, B, C, D, R (4-port); A, B, R1, R2 (2-port)                                |
| Input Frequency                        |  |
| Normal IF path                         | RF < 53 MHz: IF = 2.535 MHz<br>RF ≥ 53 MHz: IF = 7.606 MHz                                 |
| Narrowband IF path                     | IF = 10.70 MHz   |
| Input Impedance                        | 50 Ω   |
| RF Damage Level                        | +23 dBm  |
| DC Damage Level                        | 5.5 VDC  |
| 0.1 dB Compression Point               |  |
| Normal IF path                         | -9.0 dBm at 7.606 MHz  |
| Narrowband IF path                     | -17 dBm at 10.70 MHz   |
| <b>Pulse Inputs (IF Gates)</b>         |  |
| Function                               | Internal receiver gates used for point-in-pulse and pulse-profile measurements             |
| Connectors                             | 15-pin mini D-sub  |
| Input Impedance                        | 1 K Ohm  |
| Minimum Pulse Width, Source Modulators | 33 ns  |
| Minimum Pulse Width, Receiver Gates    | 20 ns  |
| DC Damage Level                        | 5.5 VDC  |
| Drive Voltage                          | 0 V (off), +3.3 V (on), nominal  |



**Table 31. (Continued) Rear Panel Information**

| RF Pulse Modulator Input (Source Modulator) |                                       |                   |
|---|---------------------------------------|-------------------|
| On/Off Ratio                                |                                       |                   |
| 10 MHz to 3.2 GHz                           | -64                                   |                   |
| 3.2 GHz to 43.5 GHz                         | -80                                   |                   |
| 43.5 GHz to 50 GHz                          | -80                                   |                   |
| Pulse Period                                |                                       |                   |
| Minimum                                     | 33 ns                                 |                   |
| Maximum                                     | 70 s                                  |                   |
| Pulse Outputs                               |                                       |                   |
| Voltage (TTL)                               | High: 3.3V to 3.5V<br>Low: <1V        |                   |
| Impedance                                   | 50 Ohm                                |                   |
| External Test Set Driver                    |                                       |                   |
| Function                                    | Used for driving remote mixers        |                   |
| Connections                                 | SMA (female)                          |                   |
| RF, LO Output Frequency Range               | 3.2 GHz to 19 GHz (N5244A and N5245A) |                   |
| Test Set Drivers (cont)                     |                                       |                   |
| Rear Panel LO Power <sup>1</sup>            | Typical (dBm)                         |                   |
|   | Upper Limit (dBm)                     | Lower Limit (dBm) |
| 1.7 GHz to 7 GHz                            | 5                                     | -3                |
| 7 GHz to 15.5 GHz                           | 0                                     | -6                |
| 15.5 GHz to 26.5 GHz                        | 4                                     | -5                |
| Rear Panel RF Power                         |                                       |                   |
| 3.2 GHz to 5 GHz                            | -2                                    | -8                |
| 5 GHz to 19 GHz                             | -3                                    | -8                |

<sup>1</sup> LO output available in full analyzer's frequency range. The power is tested only from 3.2 GHz to 26.5 GHz

**Table 31. (Continued) Rear Panel Information**

| Description  | Typical Performance  |
|--|--|
| <b>VGA Video Output</b>  |  |
| Connector  | 15-pin mini D-Sub; Drives VGA compatible monitors  |
| <b>Devices Supported</b>   | <b>Resolutions</b>   |
| Flat Panel (TFT)   | 1024 X 768, 800 X 600, 640 X 480   |
| Flat Panel (DSTN)  | 800 X 600, 640 X 480   |
| CRT Monitor  | 1280 X 1024, 1024 X 768, 800 X 600, 640 X 480  |
| Simultaneous operation of the internal and external displays is allowed, but with 640 X 480 resolution only. If you change resolution, you can only view the external display (internal display will "white out"). |  |
| <b>Bias Tee Inputs</b>   |  |
| Connectors   | BNC(f) for ports 1, 2, 3 and 4   |
| Fuse   | 500 mA, bi-pin style   |
| Maximum Bias Current   | +/-200 mA with no degradation of RF specifications   |
| Maximum Bias Voltage   | +/-40 VDC  |
| Trigger Inputs/Outputs   | BNC(f), TTL/CMOS compatible  |
| Test Set IO  | 25-pin D-Sub connector, available for external test set control.   |
| Power IO   | 9-pin D-Sub, female; analog and digital IO   |
| Handler IO   | 36-pin parallel I/O port; all input/output signals are default set to negative logic; can be reset to positive logic via GPIB command.   |
| GPIB   | Two ports - dedicated controller and dedicated talker/listener. 24-pin D-sub (Type D-24), female; compatible with IEEE-488.  |
| Parallel Port (LPT1)   | 25-pin D-Sub miniature connector, female; provides connection to printers or any other parallel port peripherals   |
| USB Ports  | Four ports on front panel (all Host) and five ports (four Host and one Device) on rear panel. Type A configuration (eight Host) and Type B configuration (one Device), USB 2.0 compatible. The total current limit for all rear panel USB ports is 2.0 amps. The total current limit for all front panel USB is limited to 0.9 amps. |
| LAN  | 10/100BaseT Ethernet, 8-pin configuration; auto selects between the two data rates   |

**Table 31. (Continued) Rear Panel Information**

| <b>Line Power - Power supply is auto switching</b> |  |
|--|--|
| Frequency, Voltage                                 | 50/60/400 Hz for 100 to 120 VAC<br>50/60 Hz for 220 to 240 VAC |
| Max  | 450 watts  |

**Table 32. Analyzer Dimensions and Weight**

All N5244A and N5245A models are shipped with bottom feet, handles, and front and rear hardware.

| Cabinet Dimensions                          |             | Metric (mm) | Imperial (inches) |
|---|-------------|-------------|-------------------|
| Height                                      |             |             |                   |
| Without bottom feet:                        | EIA RU1 = 6 | 266.1       | 10.5              |
| With bottom feet                            |             | 279.1       | 11.0              |
| Width                                       |             |             |                   |
| Without handles or rack-mount flanges       |             | 425.9       | 16.8              |
| With handles, without rack-mount flanges    |             | 458.7       | 18.1              |
| With handles and rack-mount flanges         |             | 482.9       | 19.0              |
| Depth                                       |             |             |                   |
| Without front and rear panel hardware       |             | 582.3       | 22.9              |
| With front and rear panel hardware, handles |             | 649.6       | 25.6              |

<sup>1</sup>Electronics Industry Association rack units. 1 RU = 1.75 in.

See detailed PNA dimension drawings at: <http://na.tm.agilent.com/pna/PNADimensions.pdf>

| <b>Weight</b> |   |   |
|---------------|---|---|
|               | <b>2-port models<br/>(Option 200 or 219 or 224)</b> | <b>4-port models<br/>(Option 400 or 419 or 423)</b> |
| Net           | 39.1 kg (86 lb), nominal                            | 41.8 kg (92 lb), nominal                            |
| Shipping      | 55 kg (121 lb), nominal                             | 58.2 kg (128 lb), nominal                           |

## Operating Environment

**Note:** For Regulatory and Environmental information, refer to the PNA Series Installation and Quick Start Guide, located online at <http://cp.literature.agilent.com/litweb/pdf/E8356-90001.pdf>.

## Measurement Throughput Summary

- [Typical Cycle Time for Measurement Completion](#)
- [Cycle Time vs. IF Bandwidth](#)
- [Cycle Time vs. Number of Points](#)
- [Data Transfer Time](#)

**Table 33. Typical Cycle Time<sup>a</sup> (ms) for Measurement Completion**

### All Options

|  | Number of Points |     |      |       |       |
|--|------------------|-----|------|-------|-------|
|  | 201              | 401 | 1601 | 16001 | 32001 |
| <b>Start 9 GHz, Stop 10 GHz, 600 kHz IF bandwidth</b>  |                  |     |      |       |       |
| Uncorrected  | 6                | 6.3 | 12   | 67    | 134   |
| 2-Port cal   | 24               | 26  | 36   | 155   | 310   |
| <b>Start 9 GHz, Stop 10 GHz, 10 kHz IF bandwidth</b>   |                  |     |      |       |       |
| Uncorrected  | 36               | 56  | 205  | 1960  | 3920  |
| 2-Port cal   | 80               | 119 | 416  | 3950  | 7900  |
| <b>Start 9 GHz, Stop 10 GHz, 1 kHz IF bandwidth</b>    |                  |     |      |       |       |
| Uncorrected  | 244              | 453 | 1762 | 17200 | 34400 |
| 2-Port cal   | 474              | 920 | 3547 | 34500 | 69000 |
| <b>Start 10 GHz, Stop 20 GHz, 600 kHz IF bandwidth</b> |                  |     |      |       |       |
| Uncorrected  | 24               | 27  | 42   | 94    | 147   |
| 2-Port cal   | 50               | 63  | 91   | 200   | 337   |
| <b>Start 10 GHz, Stop 20 GHz, 10 kHz IF bandwidth</b>  |                  |     |      |       |       |
| Uncorrected  | 75               | 134 | 265  | 1990  | 3964  |
| 2-Port cal   | 156              | 277 | 547  | 4025  | 7930  |
| <b>Start 10 GHz, Stop 20 GHz, 1 kHz IF bandwidth</b>   |                  |     |      |       |       |
| Uncorrected  | 240              | 466 | 1800 | 17520 | 35000 |
| 2-Port cal   | 490              | 940 | 3600 | 35092 | 70100 |

**Table 33. (Continued) Typical Cycle Time<sup>a</sup> (ms) for Measurement Completion**

|  | Number of Points |      |      |       |       |
|--|------------------|------|------|-------|-------|
|  | 201              | 401  | 1601 | 16001 | 32001 |
| <b>Start 10 MHz, Stop 50 GHz, 600 kHz IF bandwidth</b> |                  |      |      |       |       |
| Uncorrected  | 67               | 79   | 110  | 281   | 562   |
| 2-Port cal   | 137              | 163  | 225  | 552   | 1104  |
| <b>Start 10 MHz, Stop 50 GHz, 10 kHz IF bandwidth</b>  |                  |      |      |       |       |
| Uncorrected  | 100              | 165  | 539  | 2200  | 4400  |
| 2-Port cal   | 203              | 328  | 1085 | 4445  | 8890  |
| <b>Start 10 MHz, Stop 50 GHz, 1 kHz IF bandwidth</b>   |                  |      |      |       |       |
| Uncorrected  | 268              | 500  | 1860 | 17828 | 35656 |
| 2-Port cal   | 541              | 1005 | 3730 | 35735 | 71470 |

<sup>a</sup> Includes sweep time, retrace time and band-crossing time. Analyzer display turned off with DISPLAY:ENABLE OFF. Add 21 ms for display on. Data for one trace (S<sub>11</sub>) measurement.

**Table 34. Cycle Time vs. IF Bandwidth**

Applies to the Preset condition (201 points, correction off) except for the following changes:

- CF = 10 GHz
- Span = 100 MHz
- Display off (add 21 ms for display on)

| Description       |                              | Typical Performance            |
|-------------------|------------------------------|--------------------------------|
| IF Bandwidth (Hz) | Cycle Time (ms) <sup>1</sup> | Trace Noise Magnitude (dB rms) |
| 600,000           | 6.0                          | 0.026                          |
| 100,000           | 6.8                          | 0.011                          |
| 30,000            | 12                           | 0.007                          |
| 10,000            | 30                           | 0.004                          |
| 3,000             | 75                           | 0.003                          |
| 1,000             | 228                          | 0.002                          |
| 300               | 645                          | <0.001                         |
| 100               | 1831                         | <0.001                         |
| 30                | 5984                         | <0.001                         |
| 10                | 17830                        | <0.001                         |
| 3                 | 60000                        | <0.001                         |

<sup>a</sup> Cycle time includes sweep and retrace time.

**Table 35. Cycle Time vs. Number of Points**

Applies to the Preset condition (correction off) except for the following changes:

- CF = 10 GHz
- Span = 100 MHz
- Display off (add 21 ms for display on)

| Description       |                  | Typical Performance          |
|-------------------|------------------|------------------------------|
| IF Bandwidth (Hz) | Number of Points | Cycle Time (ms) <sup>1</sup> |
| 1,000             | 3                | 7.4                          |
|                   | 11               | 19                           |
|                   | 51               | 64                           |
|                   | 101              | 118                          |
|                   | 201              | 228                          |
|                   | 401              | 444                          |
|                   | 801              | 874                          |
|                   | 1,601            | 1725                         |
|                   | 6,401            | 6785                         |
|                   | 16,001           | 16782                        |
|                   | 32,001           | 33390                        |
| 10,000            | 3                | 5.3                          |
|                   | 11               | 7.4                          |
|                   | 51               | 10.7                         |
|                   | 101              | 17.5                         |
|                   | 201              | 31                           |
|                   | 401              | 56                           |
|                   | 801              | 105                          |
|                   | 1,601            | 203                          |
|                   | 6,401            | 794                          |
|                   | 16,001           | 1976                         |

|        |      |
|--------|------|
| 32,001 | 3940 |
|--------|------|



**Table 35. (Continued) Cycle Time vs. Number of Points**

| Description       |                  | Typical Performance          |
|-------------------|------------------|------------------------------|
| IF Bandwidth (Hz) | Number of Points | Cycle Time (ms) <sup>1</sup> |
| 30,000            | 3                | 5.0                          |
|                   | 11               | 5.4                          |
|                   | 51               | 6.0                          |
|                   | 101              | 7.7                          |
|                   | 201              | 12.2                         |
|                   | 401              | 18.7                         |
|                   | 801              | 33                           |
|                   | 1,601            | 66                           |
|                   | 6,401            | 242                          |
|                   | 16,001           | 597                          |
|                   | 32,001           | 1184                         |
| 600,000           | 3                | 5.0                          |
|                   | 11               | 5.1                          |
|                   | 51               | 5.2                          |
|                   | 101              | 5.2                          |
|                   | 201              | 5.3                          |
|                   | 401              | 6.0                          |
|                   | 801              | 7.6                          |
|                   | 1,601            | 11                           |
|                   | 6,401            | 30                           |
|                   | 16,001           | 68                           |
|                   | 32,001           | 130                          |

<sup>1</sup> Cycle time includes sweep and retrace time.

**Table 36. Data Transfer Time (ms)**

| Description   | Typical Performance |      |      |        |        |
|---|---------------------|------|------|--------|--------|
|   | Number of Points    |      |      |        |        |
|   | 201                 | 401  | 1601 | 16,001 | 32,001 |
| <b>SCPI over GPIB</b> (Program executed on external PC <sup>2</sup> )         |                     |      |      |        |        |
| 32-bit floating point   | 5.6                 | 10.5 | 39.9 | 400    | 800    |
| 64-bit floating point   | 10.5                | 20.3 | 79.2 | 788    | 1576   |
| ASCII   | 46                  | 92.5 | 370  | 3702   | 5404   |
| <b>SCPI over SICL/LAN or TCP/IP Socket</b> (Program executed in the analyzer) |                     |      |      |        |        |
| 32-bit floating point   | 0.18                | 0.21 | 0.5  | 3.6    | 7.2    |
| 64-bit floating point   | 0.22                | 0.28 | 0.62 | 5.3    | 10.6   |
| ASCII   | 6.3                 | 12.3 | 47.3 | 470    | 940    |
| <b>COM<sup>3</sup></b> (Program executed in the analyzer)                     |                     |      |      |        |        |
| 32-bit floating point   | <0.15               | 0.15 | 0.2  | 0.6    | 1.2    |
| Variant type  | .36                 | 0.6  | 1.8  | 17     | 35     |
| <b>DCOM over LAN<sup>3</sup></b> (Program executed on external PC)            |                     |      |      |        |        |
| 32-bit floating point   | <1.0                | 1.5  | 2.1  | 7.5    | 14     |
| Variant type  | 2.5                 | 3.5  | 10   | 84     | 168    |

<sup>1</sup> Measured with the analyzer display off. Values will increase slightly if the analyzer display is on.

<sup>2</sup> Measured when using the SCPI command DISPlay: VISible OFF.

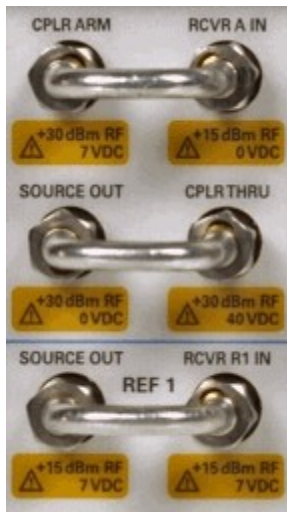
<sup>3</sup> Values are for real and imaginary pairs, with the analyzer display off.

**Note:** Specifications for Recall & Sweep Speed are not provided for the N5244A and N5245A analyzers.

## Specifications: Front-Panel Jumpers

Model N5244A and N5245A

**Note:** All PNA-X options have the following front-panel jumpers for each port.



- [Measurement Receiver Inputs](#)
  - [Reference Receiver Inputs](#)
  - [Reference Outputs \(Source Out\)](#)
  - [Source Outputs](#)
  - [Coupler Inputs](#)
-

**Table 37. Measurement Receiver Inputs****(Rcvr A IN, Rcvr B IN, Rcvr C IN, Rcvr D IN) @ 0.1dB Typical Compression**

| <b>Description</b>             | <b>Typical</b> |
|--------------------------------|----------------|
| Maximum Input Level            | All Options    |
| 10 MHz to 50 MHz <sup>1</sup>  | --             |
| 50 MHz to 500 MHz <sup>1</sup> | --             |
| 500 MHz to 1 GHz               | -2             |
| 1 GHz to 2 GHz                 | -1             |
| 2 GHz to 3.2 GHz               | 0              |
| 3.2 GHz to 10 GHz              | 0              |
| 10 GHz to 16 GHz               | -3             |
| 16 GHz to 26.5 GHz             | -2             |
| 26.5 GHz to 30 GHz             | -1             |
| 30 GHz to 32 GHz               | -1             |
| 32 GHz to 35 GHz               | -1             |
| 35 GHz to 43.5 GHz             | -1             |
| 43.5 GHz to 47 GHz             | 0              |
| 47 GHz to 50 GHz               | 0              |
| <b>Damage Level</b>            |                |
|                                | +15 dBm        |
| <b>Maximum DC Level</b>        |                |
|                                | 0 V            |

<sup>1</sup>Test port receiver compression at specified input levels below 500 MHz is negligible due to coupler roll off in this frequency range.

**Table 38. Reference Receiver Input**  
**(RCVR R1 IN) @ Max Specified Output Power**

| Description                | Typical              |                      |                      |                      |                      |                      |
|----------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
|                            | Option<br>200 or 400 | Option<br>200 or 400 | Option<br>224 or 423 | Option<br>219 or 419 | Option<br>219 or 419 | Option<br>224 or 423 |
|                            | Filtered<br>Mode     | Hi Pwr<br>Mode       | Filtered<br>Mode     | Filtered<br>Mode     | Hi Pwr<br>Mode       | Hi Pwr<br>Mode       |
| <b>Maximum Input Level</b> |                      |                      |                      |                      |                      |                      |
| 10 MHz to 50 MHz           | -33                  | -25                  | -32                  | -32                  | -27                  | -25                  |
| 50 MHz to 500 MHz          | -21                  | -16                  | -19                  | -19                  | -14                  | -14                  |
| 500 MHz-to 1 GHz           | -9                   | -4                   | -7                   | -7                   | -2                   | -2                   |
| 1 GHz to 2 GHz             | -9                   | -4                   | -7                   | -7                   | -3                   | -2                   |
| 2 GHz to 3.2 GHz           | -8                   | -6                   | -7                   | -6                   | -4                   | -5                   |
| 3.2 GHz to 10 GHz          | -3                   | -3                   | -3                   | 0                    | 0                    | -3                   |
| 10 GHz to 16 GHz           | -3                   | -3                   | -3                   | -1                   | -1                   | -3                   |
| 16 GHz to 26.5 GHz         | -3                   | -3                   | -4                   | -1                   | -1                   | -4                   |
| 26.5 GHz to 30 GHz         | -3                   | -3                   | -3                   | 0                    | 0                    | -3                   |
| 30 GHz to 32 GHz           | -4                   | -4                   | -5                   | -2                   | -2                   | -5                   |
| 32 GHz to 35 GHz           | -2                   | -2                   | -2                   | 0                    | 0                    | -2                   |
| 35 GHz to 43.5 GHz         | -3                   | -3                   | -5                   | -1                   | -1                   | -5                   |
| 43.5 GHz to 47 GHz         | -6                   | -6                   | -23                  | -5                   | -5                   | -23                  |
| 47 GHz to 50 GHz           | -19                  | -19                  | -22                  | -17                  | -17                  | -22                  |
| <b>Damage Level</b>        | +15 dBm              |                      |                      |                      |                      |                      |
| <b>Maximum DC Level</b>    | +/-7 VDC             |                      |                      |                      |                      |                      |

**Table 39a. Reference Receiver Input****(RCVR R2 IN, RCVR R3 IN, RCVR R4 IN) @ Max Specified Output Power**

| Description                | Typical   |   |  |   |   |  |
|----------------------------|---|---|--|---|---|--|
|                            | Option 400<br>RCVR R3<br>IN<br>Filtered<br>Mode | Option 400<br>RCVR R3<br>IN<br>Hi Pwr<br>Mode | Option<br>200 or 400<br>RCVR R2<br>IN<br>RCVR R4<br>IN | Option 419<br>RCVR R3<br>IN<br>Filtered<br>Mode | Option 419<br>RCVR R3<br>IN<br>Hi Pwr<br>Mode | Option<br>219 or 419<br>RCVR R2<br>IN<br>RCVR R4<br>IN |
| <b>Maximum Input Level</b> |   |   |  |   |   |  |
| 10 MHz to 50 MHz           | -31   | -23   | -27  | -31   | -26   | -25  |
| 50 MHz to 500 MHz          | -19   | -14   | -14  | -18   | -13   | -14  |
| 500 MHz-to 1 GHz           | -7  | -2  | -2   | -6  | -1  | -2   |
| 1 GHz to 2 GHz             | -7  | -2  | -2   | -6  | -2  | -2   |
| 2 GHz to 3.2 GHz           | -7  | -5  | -2   | -4  | -2  | -2   |
| 3.2 GHz to 10 GHz          | -1  | -1  | -1   | 1   | 1   | -1   |
| 10 GHz to 16 GHz           | -1  | -1  | -1   | 0   | 0   | -2   |
| 16 GHz to 26.5 GHz         | -1  | -1  | -1   | 1   | 1   | -2   |
| 26.5 GHz to 30 GHz         | 0   | 0   | -1   | 2   | 2   | -3   |
| 30 GHz to 32 GHz           | -1  | -1  | -2   | 0   | 0   | -5   |
| 32 GHz to 35 GHz           | 0   | 0   | -1   | 2   | 2   | -3   |
| 35 GHz to 43.5 GHz         | -2  | -2  | -2   | 0   | 0   | -5   |
| 43.5 GHz to 47 GHz         | -5  | -5  | -5   | -4  | -4  | -9   |
| 47 GHz to 50 GHz           | -17   | -17   | -17  | -16   | -16   | -21  |
| <b>Damage Level</b>        | +15 dBm   |   |  |   |   |  |
| <b>Maximum DC Level</b>    | +/-15 VDC                                       |   |  |   |   |  |

**Table 39b. Reference Receiver Input****(RCVR R2 IN, RCVR R3 IN, RCVR R4 IN) @ Max Specified Output Power**

| Description                | Typical                                   |   |   |
|----------------------------|---|---|---|
|                            | Option 423<br>RCVR R3 IN<br>Filtered Mode | Option 423<br>RCVR R3 IN<br>Hi Pwr Mode | Option 224 or 423<br>RCVR R2 IN<br>RCVR R4 IN<br>Filtered Mode<br>Note: No filtered mode<br>for ports 2 & 4 |
| <b>Maximum Input Level</b> |   |   |   |
| 10 MHz to 50 MHz           | -31                                       | -24                                     | -29   |
| 50 MHz to 500 MHz          | -18                                       | -13                                     | -16   |
| 500 MHz-to 1 GHz           | -6  | -1                                      | -4  |
| 1 GHz to 2 GHz             | -6  | -1                                      | -4  |
| 2 GHz to 3.2 GHz           | -5  | -3                                      | -4  |
| 3.2 GHz to 10 GHz          | 0   | 0                                       | 0   |
| 10 GHz to 16 GHz           | -2  | -2                                      | -2  |
| 16 GHz to 26.5 GHz         | -2  | -2                                      | -2  |
| 26.5 GHz to 30 GHz         | -1  | -1                                      | -2  |
| 30 GHz to 32 GHz           | -3  | -3                                      | -4  |
| 32 GHz to 35 GHz           | 0   | 0                                       | -2  |
| 35 GHz to 43.5 GHz         | -3  | -3                                      | -4  |
| 43.5 GHz to 47 GHz         | -22                                       | -22                                     | -8  |
| 47 GHz to 50 GHz           | -21                                       | -21                                     | -21   |
| <b>Damage Level</b>        | +15 dBm                                   |   |   |
| <b>Maximum DC Level</b>    | +/-15 VDC                                 |   |   |

**Table 40. Reference Output****(REF 1 SOURCE OUT) @ Max Specified Output Power**

| Description                | Typical              |                      |                      |                      |                      |                      |
|----------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
|                            | Option<br>200 or 400 | Option<br>200 or 400 | Option<br>219 or 419 | Option<br>219 or 419 | Option<br>224 or 423 | Option<br>224 or 423 |
|                            | Filtered<br>Mode     | Hi Pwr<br>Mode       | Filtered<br>Mode     | Hi Pwr<br>Mode       | Filtered<br>Mode     | Hi Pwr<br>Mode       |
| <b>Maximum Input Level</b> |                      |                      |                      |                      |                      |                      |
| 10 MHz to 50 MHz           | -33                  | -25                  | -32                  | -27                  | -32                  | -25                  |
| 50 MHz to 500 MHz          | -21                  | -16                  | -19                  | -14                  | -19                  | -14                  |
| 500 MHz-to 1 GHz           | -9                   | -4                   | -7                   | -2                   | -7                   | -2                   |
| 1 GHz to 2 GHz             | -9                   | -4                   | -7                   | -3                   | -7                   | -2                   |
| 2 GHz to 3.2 GHz           | -8                   | -6                   | -6                   | -4                   | -7                   | -5                   |
| 3.2 GHz to 10 GHz          | -3                   | -3                   | 0                    | 0                    | -3                   | -3                   |
| 10 GHz to 16 GHz           | -3                   | -3                   | -1                   | -1                   | -3                   | -3                   |
| 16 GHz to 26.5 GHz         | -3                   | -3                   | -1                   | -1                   | -4                   | -4                   |
| 26.5 GHz to 30 GHz         | -3                   | -3                   | 0                    | 0                    | -3                   | -3                   |
| 30 GHz to 32 GHz           | -4                   | -4                   | -2                   | -2                   | -5                   | -5                   |
| 32 GHz to 35 GHz           | -2                   | -2                   | 0                    | 0                    | -2                   | -2                   |
| 35 GHz to 43.5 GHz         | -3                   | -3                   | -1                   | -1                   | -5                   | -5                   |
| 43.5 GHz to 47 GHz         | -6                   | -6                   | -5                   | -5                   | -23                  | -23                  |
| 47 GHz to 50 GHz           | -19                  | -19                  | -17                  | -17                  | -22                  | -22                  |
| <b>Damage Level</b>        | +15 dBm              |                      |                      |                      |                      |                      |
| <b>Maximum DC Level</b>    | +/-7 VDC             |                      |                      |                      |                      |                      |



**Table 41a. Reference Output****(REF 2 SOURCE OUT, REF 3 SOURCE OUT, REF 4 SOURCE OUT) @ Max Specified Output Power**

| Description                | Typical  |  |  |  |  |  |
|----------------------------|--|--|--|--|--|--|
|                            | Option 400<br>REF 3<br>Source<br>Out<br>Filtered<br>Mode | Option 400<br>REF 3<br>Source<br>Out<br>Hi Pwr<br>Mode | Option<br>200 or 400<br>REF 2<br>Source<br>Out<br>REF 4<br>Source<br>Out<br>Filtered<br>Mode | Option 419<br>REF 3<br>Source<br>Out<br>Filtered<br>Mode | Option 419<br>REF 3<br>Source<br>Out<br>Hi Pwr<br>Mode | Option<br>219 or 419<br>REF 2<br>Source<br>Out<br>REF 4<br>Source<br>Out<br>Filtered<br>Mode |
| <b>Maximum Input Level</b> |  |  |  |  |  |  |
| 10 MHz to 50 MHz           | -31  | -23  | -27  | -31  | -26  | -25  |
| 50 MHz to 500 MHz          | -19  | -14  | -14  | -18  | -13  | -14  |
| 500 MHz-to 1 GHz           | -7   | -2   | -2   | -6   | -1   | -2   |
| 1 GHz to 2 GHz             | -7   | -2   | -2   | -6   | -2   | -2   |
| 2 GHz to 3.2 GHz           | -7   | -5   | -2   | -4   | -2   | -2   |
| 3.2 GHz to 10 GHz          | -1   | -1   | -1   | 1  | 1  | -1   |
| 10 GHz to 16 GHz           | -1   | -1   | -1   | 0  | 0  | -2   |
| 16 GHz to 26.5 GHz         | -1   | -1   | -1   | 1  | 1  | -2   |
| 26.5 GHz to 30 GHz         | 0  | 0  | -1   | 2  | 2  | -3   |
| 30 GHz to 32 GHz           | -1   | -1   | -2   | 0  | 0  | -5   |
| 32 GHz to 35 GHz           | 0  | 0  | -1   | 2  | 2  | -3   |
| 35 GHz to 43.5 GHz         | -2   | -2   | -2   | 0  | 0  | -5   |
| 43.5 GHz to 47 GHz         | -5   | -5   | -5   | -4   | -4   | -9   |
| 47 GHz to 50 GHz           | -17  | -17  | -17  | -16  | -16  | -21  |
| <b>Damage Level</b>        | +15 dBm  |  |  |  |  |  |
| <b>Maximum DC Level</b>    | 0 VDC  |  |  |  |  |  |

**Table 41b. Reference Output****(REF 2 SOURCE OUT, REF 3 SOURCE OUT, REF 4 SOURCE OUT) @ Max Specified Output Power**

| Description                | Typical   |   |  |
|----------------------------|---|---|--|
|                            | Option423<br>REF 3<br>Source Out<br>Filtered Mode | Options 423<br>REF 3<br>Source Out<br>Hi Pwr Mode | Option<br>224 or 423<br>REF 2<br>Source Out<br>REF 4<br>Source Out |
| <b>Maximum Input Level</b> |   |   |  |
| 10 MHz to 50 MHz           | -31   | -24   | -29  |
| 50 MHz to 500 MHz          | -18   | -13   | -16  |
| 500 MHz-to 1 GHz           | -6  | -1  | -4   |
| 1 GHz to 2 GHz             | -6  | -1  | -4   |
| 2 GHz to 3.2 GHz           | -5  | -3  | -4   |
| 3.2 GHz to 10 GHz          | 0   | 0   | 0  |
| 10 GHz to 16 GHz           | -2  | -2  | -2   |
| 16 GHz to 26.5 GHz         | -2  | -2  | -2   |
| 26.5 GHz to 30 GHz         | -1  | -1  | -2   |
| 30 GHz to 32 GHz           | -3  | -3  | -4   |
| 32 GHz to 35 GHz           | 0   | 0   | -2   |
| 35 GHz to 43.5 GHz         | -3  | -3  | -4   |
| 43.5 GHz to 47 GHz         | -22   | -22   | -8   |
| 47 GHz to 50 GHz           | -21   | -21   | -21  |
| <b>Damage Level</b>        | +15 dBm   |   |  |
| <b>Maximum DC Level</b>    | 0 VDC   |   |  |

**Table 42a. Source Outputs****(PORT 1 SOURCE OUT, PORT 2 SOURCE OUT, PORT 3 SOURCE OUT, PORT 4 SOURCE OUT) @ Max Specified Output Power**

| Description                    | Typical  |  |  |  |  |  |
|--------------------------------|--|--|--|--|--|--|
|                                | Option<br>200 or 400<br>Port 1<br>Source<br>Out<br>Port 3<br>Source<br>Out<br>Filtered<br>Mode | Option<br>200 or 400<br>Port 1<br>Source<br>Out<br>Port 3<br>Source<br>Out<br>Hi Pwr<br>Mode | Option<br>200 or 400<br>Port 2<br>Source<br>Out<br>Port 4<br>Source<br>Out | Option<br>219 or 419<br>Port 1<br>Source<br>Out<br>Port 3<br>Source<br>Out<br>Filtered<br>Mode | Option<br>219 or 419<br>Port 1<br>Source<br>Out<br>Port 3<br>Source<br>Out<br>Hi Pwr<br>Mode | Option<br>219 or 419<br>Port 2<br>Source<br>Out<br>Port 4<br>Source<br>Out |
| <b>Maximum Input Level</b>     |  |  |  |  |  |  |
| 10 MHz to 50 MHz <sup>1</sup>  | 4  | 12   | 12   | 5  | 10   | 13   |
| 50 MHz to 500 MHz <sup>1</sup> | 8  | 13   | 13   | 9  | 14   | 14   |
| 500 MHz-to 1 GHz               | 8  | 13   | 13   | 9  | 14   | 14   |
| 1 GHz to 2 GHz                 | 9  | 14   | 14   | 9  | 13   | 14   |
| 2 GHz to 3.2 GHz               | 9  | 11   | 14   | 9  | 11   | 14   |
| 3.2 GHz to 10 GHz              | 14   | 14   | 14   | 14   | 14   | 14   |
| 10 GHz to 16 GHz               | 14   | 14   | 14   | 13   | 13   | 13   |
| 16 GHz to 26.5 GHz             | 14   | 15   | 15   | 13   | 13   | 13   |
| 26.5 GHz to 30 GHz             | 14   | 14   | 14   | 12   | 12   | 12   |
| 30 GHz to 32 GHz               | 13   | 13   | 13   | 10   | 10   | 10   |
| 32 GHz to 35 GHz               | 14   | 14   | 14   | 12   | 12   | 12   |
| 35 GHz to 43.5 GHz             | 11   | 11   | 11   | 8  | 8  | 8  |
| 43.5 GHz to 47 GHz             | 8  | 8  | 8  | 4  | 4  | 4  |
| 47 GHz to 50 GHz               | -5   | -5   | -5   | -8   | -8   | -8   |
| <b>Damage Level</b>            | +30 dBm  |  |  |  |  |  |
| <b>Maximum DC Level</b>        | 0 VDC  |  |  |  |  |  |

**Table 42b. Source Outputs****(PORT 1 SOURCE OUT, PORT 2 SOURCE OUT, PORT 3 SOURCE OUT, PORT 4 SOURCE OUT) @ Max Specified Output Power**

| Description                    | Typical   |   |   |
|--------------------------------|---|---|---|
|                                | Option 224 or 423<br>Port 1 Source Out<br>Port 3 Source Out | Option 224 or 423<br>Port 1 Source Out<br>Port 3 Source Out | Option 224 or 423<br>Port 2 Source Out<br>Port 4 Source Out |
|                                | Filtered Mode   | Hi Pwr Mode   |   |
| <b>Maximum Input Level</b>     |   |   |   |
| 10 MHz to 50 MHz <sup>1</sup>  | 5   | 12  | 11  |
| 50 MHz to 500 MHz <sup>1</sup> | 9   | 14  | 14  |
| 500 MHz-to 1 GHz               | 9   | 14  | 14  |
| 1 GHz to 2 GHz                 | 9   | 14  | 14  |
| 2 GHz to 3.2 GHz               | 9   | 11  | 14  |
| 3.2 GHz to 10 GHz              | 14  | 14  | 14  |
| 10 GHz to 16 GHz               | 13  | 13  | 13  |
| 16 GHz to 26.5 GHz             | 13  | 13  | 13  |
| 26.5 GHz to 30 GHz             | 12  | 12  | 12  |
| 30 GHz to 32 GHz               | 10  | 10  | 10  |
| 32 GHz to 35 GHz               | 12  | 12  | 12  |
| 35 GHz to 43.5 GHz             | 8   | 8   | 8   |
| 43.5 GHz to 47 GHz             | 3   | 3   | 3   |
| 47 GHz to 50 GHz               | -9  | -9  | -10   |
| <b>Damage Level</b>            | +30 dBm   |   |   |
| <b>Maximum DC Level</b>        | 0 VDC   |   |   |

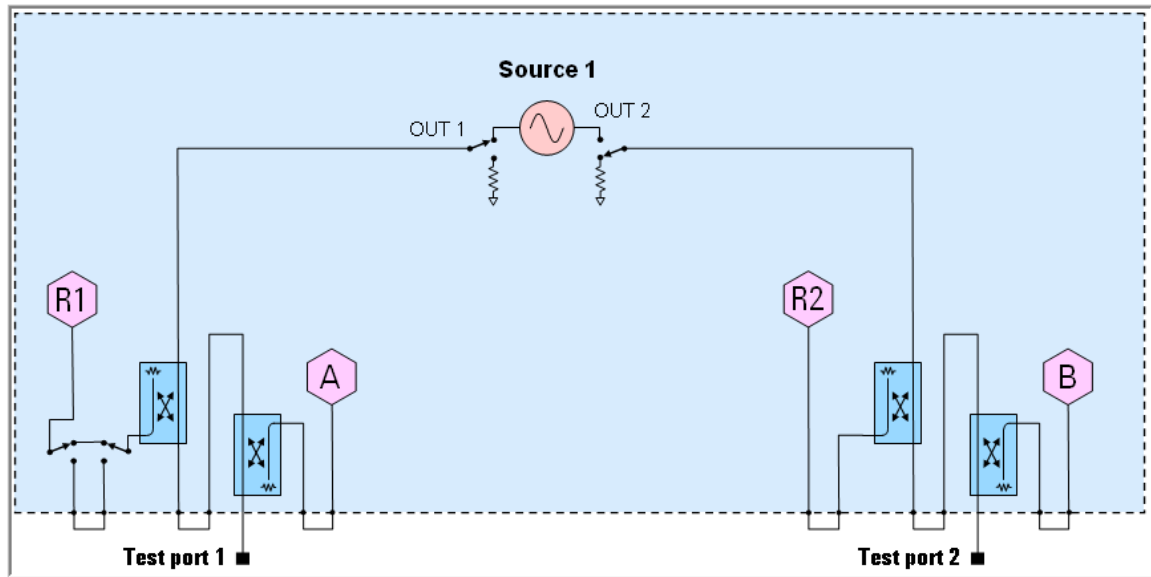
**Table 43. Coupler Inputs****(PORT 1 CPLR THRU, PORT 2 CPLR THRU, PORT 3 CPLR THRU, PORT 4 CPLR THRU) Insertion Loss of Coupler Thru**

| Description                    | Typical           |                                  |
|--------------------------------|-------------------|----------------------------------|
|                                | Option 200 or 400 | Option 219 or 419 or 224, or 423 |
| <b>Maximum Input Level</b>     |                   |                                  |
| 10 MHz to 50 MHz <sup>1</sup>  | -0.25             | -1                               |
| 50 MHz to 500 MHz <sup>1</sup> | -0.25             | -1                               |
| 500 MHz to 1 GHz               | -0.5              | -1                               |
| 1 GHz to 2 GHz                 | -0.5              | -1                               |
| 2 GHz to 3.2 GHz               | -1                | -1                               |
| 3.2 GHz to 10 GHz              | -1                | -1                               |
| 10 GHz to 16 GHz               | -1                | -2                               |
| 16 GHz to 26.5 GHz             | -1.5              | -2.5                             |
| 26.5 GHz to 30 GHz             | -2                | -3                               |
| 30 GHz to 32 GHz               | -2                | -3                               |
| 32 GHz to 35 GHz               | -2                | -3                               |
| 35 GHz to 43.5 GHz             | -2.5              | -4                               |
| 43.5 GHz to 47 GHz             | -2.5              | -5                               |
| 47 GHz to 50 GHz               | -3                | -6                               |
| <b>Damage Level</b>            | +30 dBm           |                                  |
| <b>Maximum DC Level</b>        | +/-40 VDC         |                                  |

## Test Set Block Diagrams

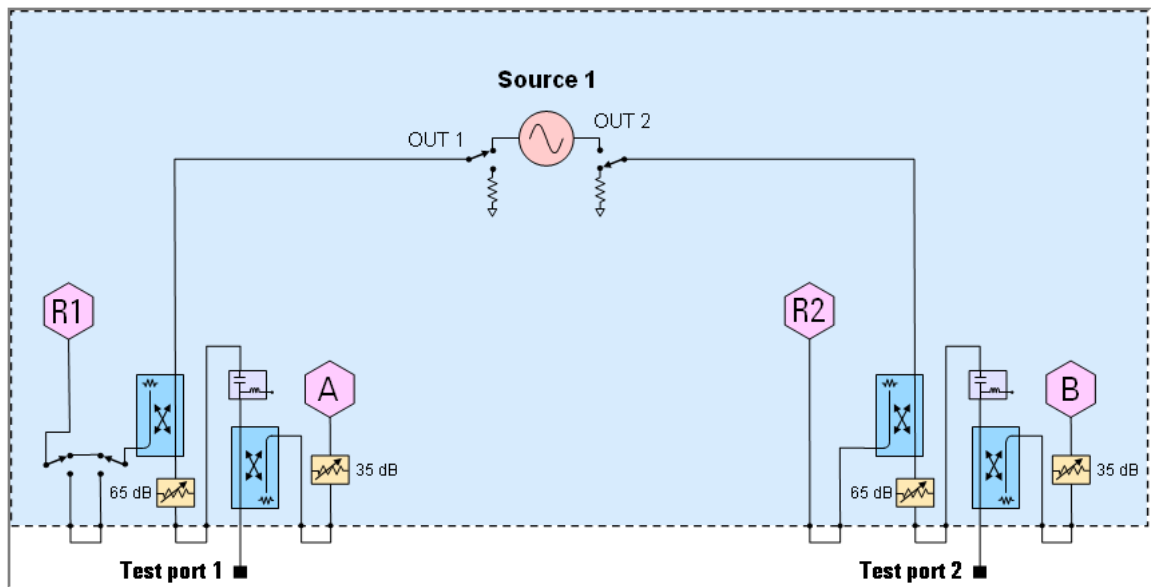
**NOTE:** For best readability, use a color printer for printing the following graphics.

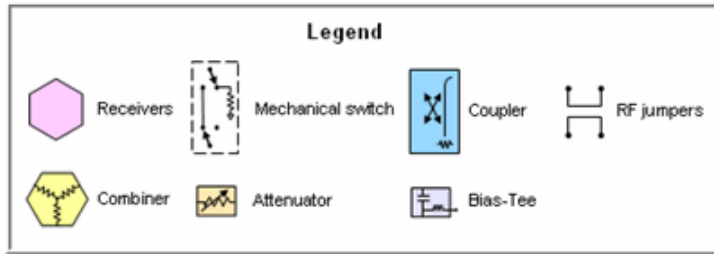
**Figure 15. 2-Port N5244A and N5245A Base Unit Option 200**



**Figure 16. 2-Port N5244A and N5245A Option 219**

Adds Extended power range: source and receiver attenuators, and bias-tees

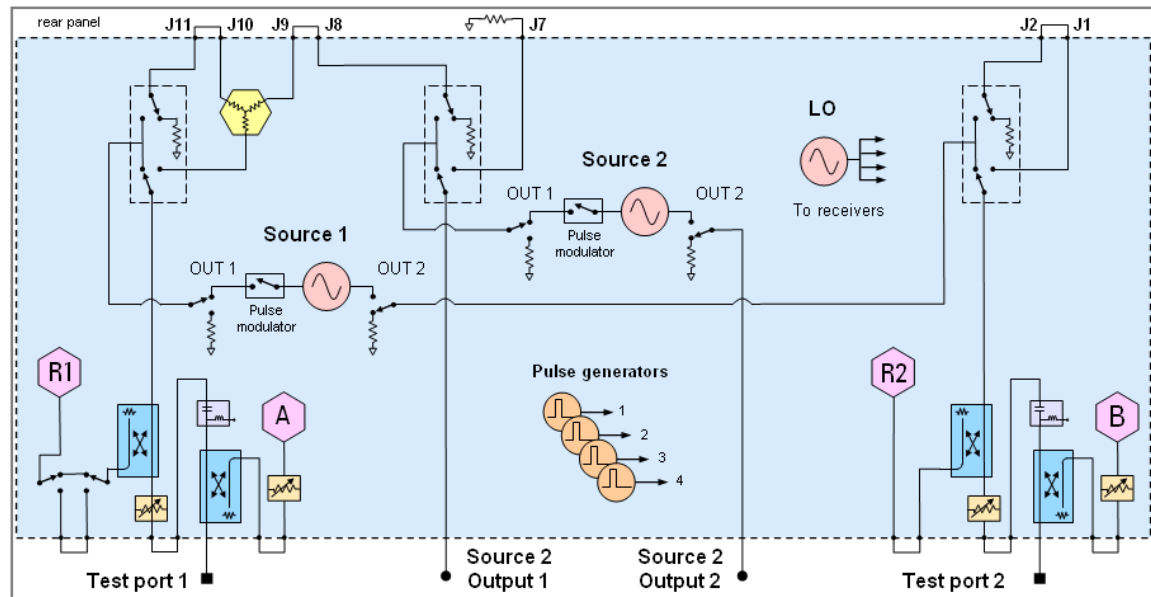




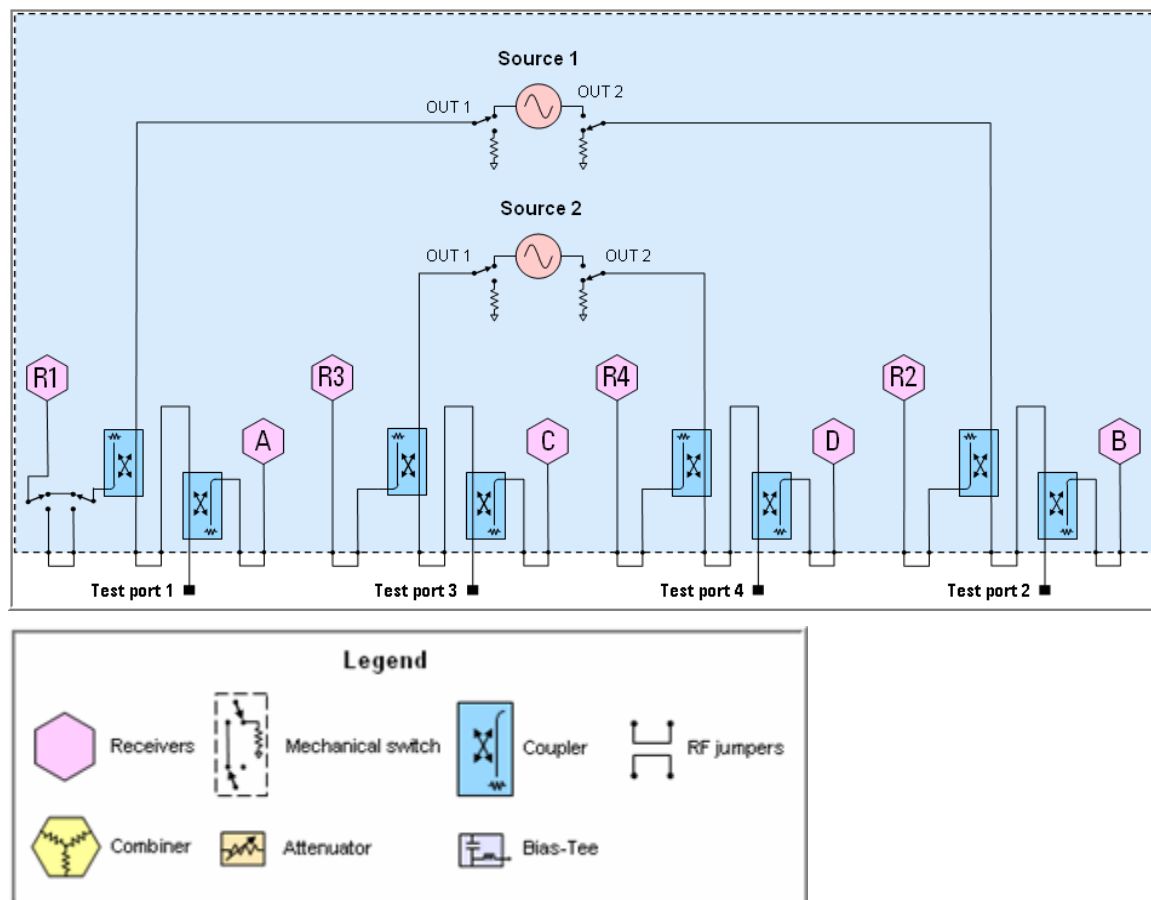
**Figure 17. 2-Port N5244A and N5245A Option 224**

Adds internal second source, combiner, and mechanical switches

Also shown, Option 025 adds 4 pulse generators. Option 021 and 022 adds pulse modulators.



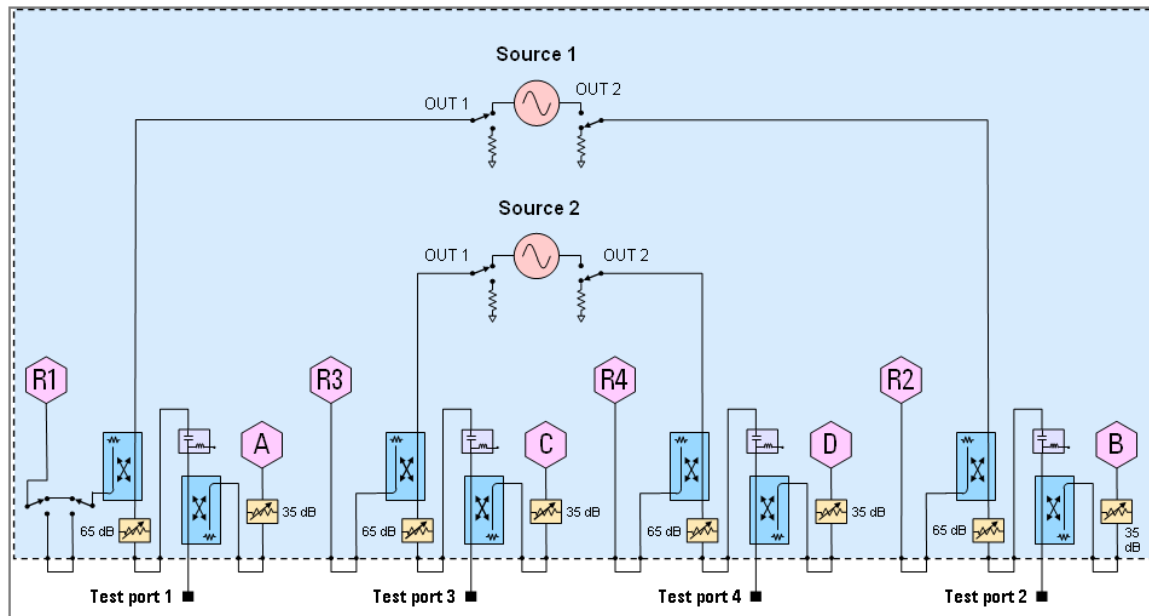
**Figure 18. 4-Port N5244A and N5245A Base Unit - Option 400**





**Figure 19. 4-Port N5244A and N5245A Option 419**

Adds Extended power range: source and receiver attenuators, and bias-tees.



**Figure 20. 4-Port N5244A and N5245A Option 423**

Adds internal combiner and mechanical switches.

Also shown, Option 025 adds 4 pulse generators. Option 021 and 022 adds pulse modulators.

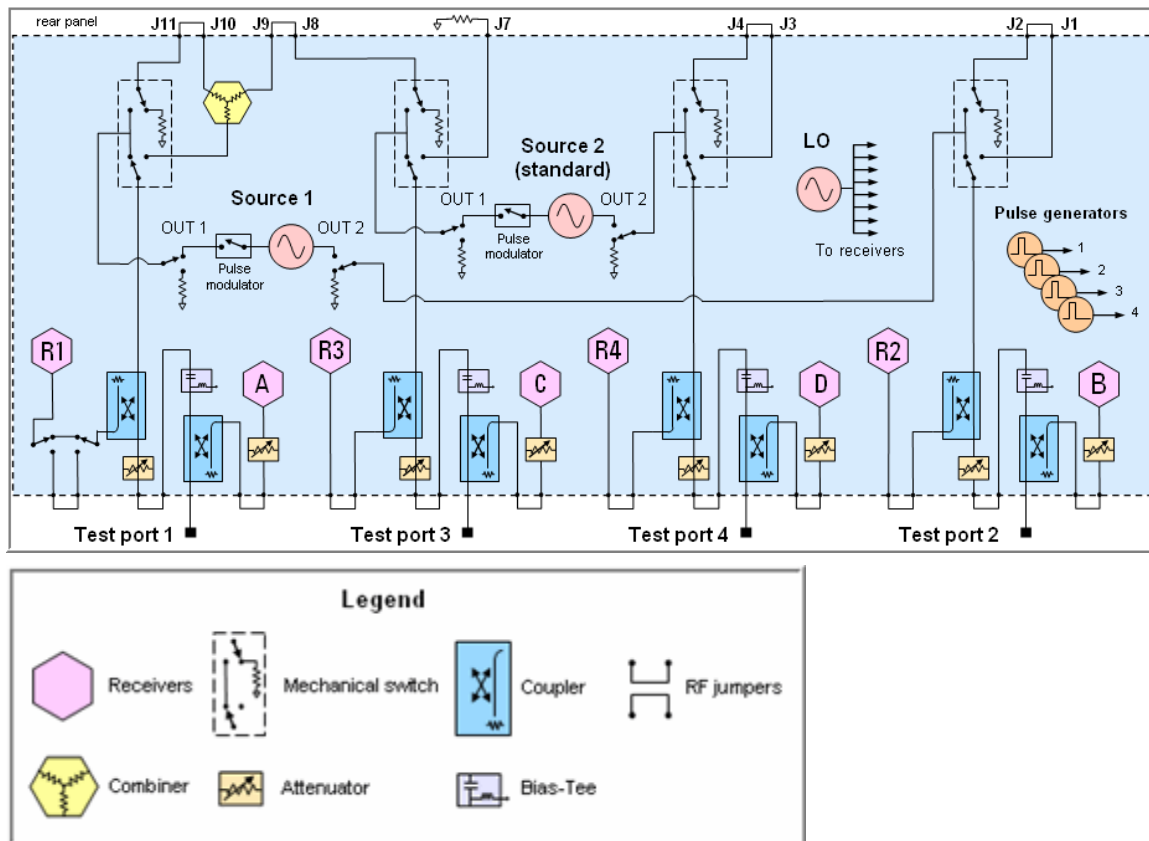
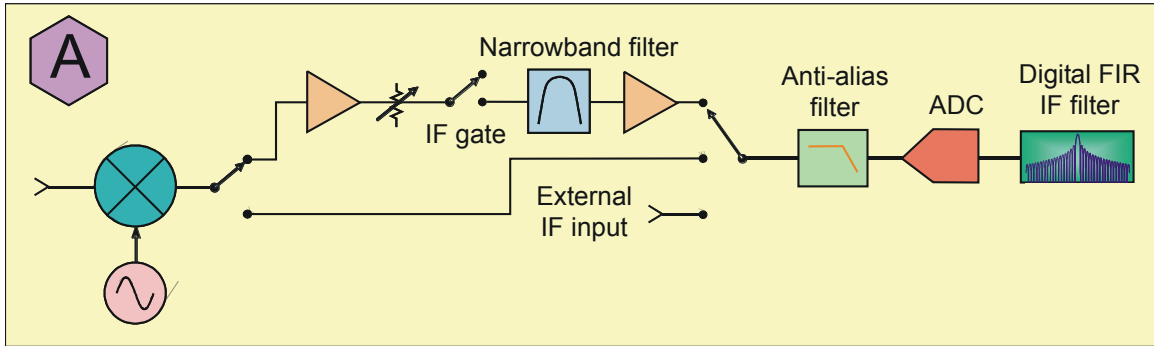


Figure 21. Receiver Block Diagram





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